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BULLETIN

OF THE

SANTA BARBARA SOCIETY OF NATURAL HISTORY.

VOL. I. NO. 2.

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ISSUED OCTOBER, 1890.

COMMERCIAL JOB PRINTING HOUSE.

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SANTA BARBARA

SOCIETY OF NATURAL HISTORY.

VOL. I. NO. 2.

1887--1890.

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SANTA BARBARA, CALIFORNIA:
1890.

Commercial Job Printing House.

OFFICERS

OF THE

Santa Barbara Society of Natural History

For 1890.

PRESIDENT.

HENRY CHAPMAN FORD.

VICE-PRESIDENTS.

1st—LORENZO GORDIN YATES, F. L. S.
2d—JAMES W. CALKINS.
3d—MRS. A. A. BOYCE.

TREASURER.

MRS. MARY A. ASHLEY.

CORRESPONDING AND RECORDING SECRETARY.

LORENZO GORDIN YATES.

CURATOR AND LIBRARIAN.

MRS. F. C. LORD.

PUBLICATION COMMITTEE.

H. C. FORD, L. G. YATES.

REPORT ON MUSEUM AND LIBRARY.

JULY 1890.

NATURAL HISTORY.

Entomology—
Species, 299.

Ornithology—
Mounted Birds, 85.
Eggs, 132.
Birds' Nests, 6.

Mammals—
5 species, mounted.

Conchology—
Marine and Fresh Water Shells, about 900 species, including collections from Mr. J. W. Calkins, Mrs. A. A. Boyce, Dr. De Camp, H. C. Ford, Dr. L. G. Yates, Mrs. C. F. Bingham and others.

Crustacea—
Marine specimens, 12.
Corals, numerous specimens.

Reptiles—
33 species, in alcohol.

Botanical—
Marine Algæ, 330 species.
Flowering Plants, about 2000 mounted specimens, including a large number by Mrs. C. F. Bingham.
Miscellaneous varieties, 80.

Geological—
Fossils, 69 species, including Fossil Corals, Crinoids, Fish, Shells and Insects.

Minerals, Ores and Rocks—
Over 500 specimens.

Miscellaneous—

Large Oil Painting of the "Grizzly Giant," (Sequoia gigantea), painted by Mr. H. C. Ford.

A number of Photographs and Curios.

Stone Chair, used by the Incas of Ecuador, South America; found near Guayaquil; donated by Mrs. E. Piper.

Indian Relics—

Over 700 varieties, including Chipped Stone Implements; Stone Mortars and Pestles; Cooking and Food Vessels; Pipes; Perforated Disks; Carved Implements of Stone; Implements of Bone, Needles, Perforaters, Whistles, &c.; Textile Fabrics; Ornaments of Shell and Stone; Charm Stones; 1 Black Slate "Totem" from Alaska.

LIBRARY.

Bound Vols. to date	2,053
Pamphlets and parts of Vols	3,534

MRS. F. C. LORD,
Curator and Librarian.

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PRESIDENT'S ANNUAL ADDRESS FOR 1889.

AT the December meeting of the Society, President Ford read the following report: Another year is added to our Society's existence, the thirteenth since its organization. In reviewing our work since our last annual report we find much encouragement. The regular monthly meetings have been well attended, and at each, one or more papers of interest and scientific value have been presented, the discussion of which, has, I trust, been profitable to us all.

Donations to the museum and library have been frequent and important, among the most valuable contributions to the former being a stone chair presented by Mrs. A. D. Piper, one of our members. It is one of three, found on a mountain near Guayaquil, Ecuador, placed around a large stone table. These relics are referred to the age of the Incas. A detailed account of their discovery and probable origin has been forwarded to the Society of California Pioneers in San Francisco, that has in its possession one of the chairs. Our Society is promised a duplicate description, which, as soon as received, will be made public.

It is not generally known that our library is a depository of all the publications issued by the United States Government, and the yearly accessions to our shelves from this source are of such proportions that we cannot properly place them in our present cramped quarters. By the kindness of the Trustees of the Public Library we have been accorded space outside our own rooms for two cases that are already filled. In the plans for the new library building we understand ample rooms are to be provided for the Society's use. As works of reference, the Government publications are of exceeding value, and our librarian has classified them as far as possible, so that little trouble is had by any person wishing to consult them. Our rooms are accessible during the Public Library hours to every one, but only members of the Society can draw the books from the rooms.

We are offered several valuable collections for our museum, either as a loan or donation, as soon as suitable wall space and cases are provided.

Parties are now negotiating for the Jewett collection of marine and fresh water moluscs now in possession of Mrs. A. A. Boyce, with a view to its being transferred to a suitable place for exhibition and study. It is a matter of regret that it cannot remain in the city where its distinguished collector died, and where his daughter the present owner resides. It was hoped that some friends of our society would donate the requisite funds for its purchase as an exceedingly valuable addition to our museum.

Since the publication of our first Bulletin a number of important papers have been read at our meetings, and their accumulation is such, that a committee has been appointed to select the most valuable for issue in a second volume.

The meager funds in our treasury do not warrant the incursion of the necessary expense attending its publication without calling upon friends of the Society outside of its membership. The committee has met with such encouragement, that enables us to say that there is a probability of its issue early in the new year. Should this be accomplished the Society will be enabled to make exchanges for the valuable transactions of sister scientific organizations throughout the world.

During the past year our membership has increased, but we have lost by removal, the valued association and council of several who have been with us since the Society's birth. There are still many students of nature in our midst who are not working with us. I would suggest that increased effort be made to add to our numbers.

Our young fellow member Clark P. Streator after making many extensive ornithological collections in Jamaica, and other West India Islands, has during the last year been collecting in British Columbia, including the main land and Vancouvers Island, where he has secured about 1,500 specimens, among which are one or two species of birds new to the scientific world.

Dr. L. G. Yates has visited the Channel Islands for scientific investigation, and the results of his trip are already embodied in papers read before the Society.

Other contributions on the same localities are to follow. Although these Islands have been visited by several botanists—among them recently Profs. Greene and Brandegee, both of whom discovered many new species—the interesting field is far from being exhausted, as none have yet seen the early spring flora of the region.

Dr. Yates has during the last year been honored by his election as a Fellow of the Linnean Society of London, a distinction that now rests upon only six citizens of the United States. He is about to publish a list of "All Known Ferns," assisted by John Gilbert Baker, F. R. S., of the Royal Herbarium at Kew. This will be a valuable contribution to fern knowledge, containing as it will, the habitat, synonyms, etc., of all known ferns of the world.

It is with some humiliation that we announce the removal to Ventura of the telescope recently belonging to our late member, Rev. S. Weldon. There ought to have been sufficient scientific interest and public spirit among our citizens to have retained it in Santa Barbara.

The thanks of the Society are due to our curator and librarian, Mrs. F. C. Lord, for the efficient manner in which her gratuitous duties have been performed, and I would heartily recommend her continuance in office. She has given much time to the arrangement of the library and museum, and is always present on Saturday afternoons to answer questions in regard to our collections.

You are respectfully referred to the detailed reports of the secretaries, treasurer, curator and librarian for further information. H. C. FORD, President.

NOTES ON THE FERNS OF THE CHANNEL ISLANDS,

Off the Coast of California.

BY DR. LORENZO G. YATES, F. L. S., ETC.

THE coast line of California has a general trend north and south, for nearly its entire length of 770 miles. This general direction is broken at a point about 200 miles south from San Francisco, where it makes a sudden bend easterly for a distance of about 90 miles.

South of this east and west line of coast, at a distance of some 25 miles, and running parallel therewith, is a chain of islands which form the southerly wall of the Santa Barbara Channel.

These islands consist of the San Miguel, Santa Rosa, Santa Cruz, and the Anacapas. They are all of volcanic origin, and have attracted considerable attention from botanists, from the many peculiarities of their flora discovered and recorded within the past few years, and have presented some puzzling questions, the solution of which bid fair to remain *open* questions, for some time to come.

Among these peculiarities are the discovery of a large number of species, and some genera of plants peculiar to these islands, or to certain islands of the group.

Prof. Edward L. Greene in his "Catalogue of the Flowering Plants and Ferns Collected on the Island of Santa Cruz," published in the "Bulletin of the California Academy of Sciences, 1887," enumerates 321 species of plants, of which number 48 species were at that time considered peculiar to Santa Cruz and the other islands off the coast, while 28 species were peculiar to Santa Cruz itself.

This catalogue is preceded by interesting notes and generalizations, in which he calls attention to the anomalous floral peculiarities of the archipelago, and more particularly to the Island of Santa Cruz.

During a recent short stay upon the Islands the writer made a discovery which adds another to the many curious facts in relation to the flora of these Islands which have already been recorded, having found Polypodium Scouleri, *H. & G.*, growing luxuriantly among the projecting fragments of volcanic rock at the mouth of one of the most interesting caves on the island. This fern has not so far as I know, been reported south of the neighborhood of the Bay of San Francisco, nearly 300 miles north from this island, except in one instance, where Dr. Palmer reported it from Guadalupe Island, off the coast of Mexico, several hundred miles south.

In May, 1887, I published the occurrence of Cheilanthes myriophylla, *Desv.*, on Santa Cruz Island; the specimen was collected by Prof. H. C. Ford. This seems to be the northern limit of this tropical species, thus furnishing another illustration of the peculiar overlapping of species noted in my article on ferns in "Santa Barbara As It Is."

In the spring of 1887 Prof. Ford made some collections on Santa Cruz Island, of which some of the ferns were given to me for determination, and I believe the first published notice of the ferns of these Islands was that of Cheilanthes above referred to.

Later in the same year Prof. Greene published the results of his collections. In 1888 Mr. T. S. Brandegee, in an article published in "Proceedings of the California Academy of Science," 1889, added three more species to Prof. Greene's list.

In August of the present year, during a stay of a few hours upon Santa Cruz Island, Prof. H. C. Ford and myself collected or noted all the species noted by former collectors, excepting four species, and found one additional species (Polypodium Scouleri); we found fronds of Cheilanthes myriophylla growing to a height of over 20 inches.

The following table has been prepared to preserve a record of the known species of ferns of these islands:

Table of the Ferns of the Islands of Santa Cruz and Santa Rosa.

SANTA CRUZ.

Collected or noted by	H. C. Ford.	E. L. Greene.	T. S. Brandegee.	L. G. Yates.
Polypodium Californicum, *Kaulf*		1886		1889
* " Scouleri, *H. & G*				1889
Pellæa ornithopus, *Hook*		1886		1889
" andromedæfolia, *Fee*		1886		1889
" " var				1889
Cheilanthes Californica, *Mett*		1886		
§ " myriophylla, *Desv*	1887		1888	1889
? Notholæna candida, *Hook*		1886		
Pteris aquilina, *Linn*		1886		1889
Adiantum pedatum, *Linn*	1887	1886		1889
" Capillus-veneris, *Linn*		1886		
" emarginatum, *Hook*			1888	1889
Woodwardia radicans, *Sm*		1886		1889
Aspidium munitum, *Kaulf*		1886		
" rigidum, *Swtz*		1886		1889
Gymnogramme triangularis, *Kaulf*			1888	1889
" " var				1889

* This fern not before noted South of the vicinity of the Bay of San Francisco, except on the Guadalupe Island, off the coast of Mexico, by Dr. Palmer.

§ First published by L. G. Yates in 1887.

In addition to the above, both Ford and Greene report a large growing species which was not determined.

SANTA ROSA.

	L. G. Yates.	T.S.Brandegee
Polypodium Californicum, *Kaulf*	1876	1888
Pellæa andromedæfolia, *Fee*	1876	1888
Gymnogramme triangularis, *Kaulf*	1876	1888
Pteris aquilina, *L.*	1876	1888
Adiantum emarginatum, *Hook*	1876	1888
Aspidium rigidum, *Swtz*	1876	1888

I do not know of any ferns having been found on either San Miguel or the Anacapas. Prof. Greene reports that "no ferns grow on San Miguel," and our party failed to find any on the Anacapas, but they may exist on the western island which we did not thoroughly explore.

SPECIMENS OF CONIFEROUS WOOD SATURATED WITH BITUMEN.

BY PROF. H. C. FORD.

This wood was obtained from an ocean cliff at Carpinteria, on the land owned by Mr. P. C. Higgins. Some years ago I noticed some logs of wood protruding from this cliff but not until a recent visit have I been able to make a detailed examination of the locality and the specimens. The wood was imbedded at a depth of 25 feet from the top of the cliff and about 10 feet above tide water. The overlying material consists as follows: (1), 4 feet of surface dirt, (2), 3 feet of sand stone, (3), 4 feet of sandstone containing water worn boulder, (4), 3 feet bituminous sandstone, (5), sandstone conglomerate with boulders from 3 to 6 inches in diameter. In this the logs are imbedded. Below them is 3 feet of the same rock, resting on light colored limestone. At the point where the wood is found this ancient drift sinks into the limestone in a pocket-like depression which would indicate a suitable resting place for the wood after diluvial action.

The wood bears the undoubted characteristics of the coniferous family and seems to be a Sequoia, whether the sempervirens, gigantea or extinct species, I am unable to determine. It is highly impregnated with bitumen and to this fact may be owing its well preserved structure. Fragments burn with a clear flame, the mass passing into a semi-fluid state similar to first-class bituminous coal before entire consumption. In the neighborhood are numerous places where the bituminous tar is oozing from the rocks.

ALLANITE.

BY DR. L. G. YATES, F. L. S.

This mineral was named after Mr. T. Allan, who discovered it among mineral specimens taken from

East Greenland to Scotland by Mr. C. Giesecke; it has since been reported from one locality in Norway, two localities in Pennsylvania, East Bradford and Bethlehem; from Franklin, N. J., and some few other localities furnish varieties of the species. Now Santa Barbara claims the distinction of furnishing a new locality.

This mineral is a peculiar combination of some of the rarer metals cerium, lanthanum, didymium and sometimes yttrium and traces of glucinum, silica, alumina, lime and iron being always present, magnesium and water in nearly all of the reported analyses, and occasionally manganese, soda and copper. It is quite varied in its composition and appearance, and although neither beautiful to the eye, nor of commercial value, it is very interesting to mineralogists, and adds one more species to the list of the minerals of California.

NOTE.—The Annual Report of our State Mineralogist for 1889, reports the following minerals from Santa Barbara, which have not been previously noted from California:

Gilsonite, a new hydrocarbon; one pound of this mineral dissolved in five pounds of turpentine gently heated makes an excellent japanning varnish, applied to metallic surfaces, and then baked, becomes quite hard. This varnish, mixed with half a pint of oil, renders some fabrics water proof, and will be flexible when the varnish is perfectly dry.

Pectolite, a silicate of aluminum, calcium, natrium, found near Santa Barbara, and also in Tehama county.

CHARM STONES.

Notes on the So-Called "Plummets" or "Sinkers."

BY DR. LORENZO G. YATES, F. L. S.; F. G. S. A., ETC.

[Corresponding Member of the Anthropological Society of Washington.]

THE principal portion of the following "notes,' together with the illustrations, were published in the Annual Report of the Smithsonian Institution for 1886.

The manuscript and illustrations were sent to Washington to be submitted to the late Prof. Spencer F. Baird for advice in relation to their publication, but he was absent, and his death occurred shortly after; the article was afterwards placed in the hands of the Public Printer for publication.

The descriptions of the illustrations and some additional notes were however lost, and the present edition is republished under the auspices of the Santa Barbara Society of Natural History, in which are incorporated some later observations on the subject.

Since the publication of the first edition I have found some of my original notes which were made nearly 20 years ago, the facts of which I have added to the notes already published.

Several years ago an article appeared in the American Naturalist (November, 1872), by J. G. Henderson, on the subject of "plummets," in which, after describing and figuring several specimens found at various places, he offered some conjectures as to their uses, six of which uses he enumerates as probable:

(1) As slung-shots.

(2) As sinkers for fishing-tackle.

(3) In playing some game.

(4) As sacred implements in performing some religious ceremonies.

(5) As personal ornaments.

(6) As plummets and levels.

After giving his reasons at some length in each of these supposed uses, he dismisses all except the last, which he decides were the uses to which they were put. In a note appended to the article, Prof. F. W. Putnam states that "he has considered the implements generally classed under the names plummets and sinkers to represent to a greater or less extent, according to size, material, shape and finish; first, pestles; second, sinkers; third, spinning weights; fourth, ornaments."

Mr. Henderson gives a number of localities where these implements have been found. My attention was particularly attracted by the statement that "about ten years ago one of these implements was found under remarkable circumstances in Woodbridge County, Cal." there being no such county in California.

I commenced an article on this subject at that time, but press of other matters and a desire to obtain as much reliable information as possible have prevented its completion.

During the years that have elapsed since the inception of this article, I have noted the various theories advanced by different writers as to the uses of these singular implements.

A great many have written on the subject, and all have accepted some one or more of the various theories projected.

Foster, in his Prehistoric Races of the United States, classes the plummet-shaped stones under the head of "weights which may have been used in the process of weaving," and figures three varieties of them (see Figs. 31, *a*, *b*, *c*, p. 230, Prehistoric Races), as "weights to keep the threads taut."

Thomas Ewbank, in his "Life in Brazil," published in 1856, figures two implements which might be classed with those under consideration. I have copied from his illustration on page 451 of his appendix (see Fig. A). He says : "It resembles an egg in shape, is of black, hard, smoothly polished stone, used for working metal." On page 464 of the same appendix is figured an implement exactly like some of our so-called plummets (see Fig. B), of which he says: "Which, from the notch cut round its pointed end, may have been used as a plumb-line or as a spindle." In the "Third Annual Report of the Bureau of Ethnology," by J.W. Powell, director, published in 1884, on pages 509 and 510, are descriptions of implements in a collection from Peru, "neatly made sinkers wrapped in corn husks and sinkers of gray slate, shaped somewhat like a cigar, with one or more grooves partially encircling the end. These were wrapped in corn husks."

The figure given on page 510 represents the ordinary so-called plummets, except that there are two grooves on the smaller end and one on the larger. These grooves only partially encircle the implement and are all on the same side.

Abbott,in his "Primitive Industry," very properly separates the plummets and sinkers, devoting one chapter to each.

In the chapter on plummets he gave illustrations of several implements found in Illinois, Ohio, New Jersey, Massachusetts and Maine. These are nearly identical in general form and outline with those found on the Pacific Coast. He says: "While the general name given to the group is convenient, and in a measure descriptive of their appearance, it has but little reference to their uses. It has been remarked that their principal use as plummets may be questioned, as there are far too many of them found and of too great variation in size to lead us to infer that they were used mainly for that purpose."

He remarks of Fig. 216, which he states "is a characteristic specimen of the New England plummet of about the maximum size: Whether it should be classed as a pestle or not can not be readily determined, but from the fact that unquestionable pestles are by no means infrequent in the same localities, and also for the reason that the larger plummet-shaped implements are of too soft a material and seldom exhibit signs of use at their rounded end."

In his chapter on sinkers, he seems to be very uncertain as to whether the Indians were acquainted with the methods of catching fish with nets, and the probabilities are that the Europeans first taught the use of nets to the aborigines. If such is the case, then the "plummets" were certainly not sinkers.

As for the great size of the larger one being no objection to their use as sinkers, it may be doubted if they (the Indians) knew how, or cared to fish with nets.

They had their certain seasons for fishing, when they knew where to find them and how to catch them. At other times they would be in other localities, hunting other food materials in their season.

A few of the grooved stones and notched pebbles classed as undoubted net sinkers have been found in California. Fig. 22 represents one from Bodega, Cal. Might not some of them have been used as war-clubs or hammers? And were not the grooves made for the purpose of attaching handles of withes? Their shape would indicate their use in some of their manufactures, whereas a "net sinker" would not require to be made after any particular pattern; anything possessing the requisite weight, and of any form that could be attached to the net, would have answered the purpose.

If the Indians did not fish with nets, these "undoubted net sinkers" were *not* "net sinkers," and if used in fishing at all they were line sinkers. The Indian Rafael, who will be referred to hereafter, when shown the implement represented by Fig. 22, said that it was used as a line sinker for fishing.

In "Explorations of the Aboriginal Remains of Tennessee," by Joseph Jones, M. D., published by the Smithsonian Institution, under the head of "Stones Employed for Mechanical Purposes," is a figure and description of a plummet of black magnetic iron, highly polished, with a hole through the upper end; and he supposes that this, together with a number of similar implements which have been found in Middle Tennessee in the cultivated soil, and also in the stone graves, were used in spinning threads and in weaving. He says: "It has been suggested that they may also have been employed as weights in fishing." Had they been used in spinning and weaving, as Dr. Jones suggests, they would probably have been made of uniform size and shape.

Dr. Charles Rau, in "The Archæological Collection of the United States National Museum," published by the Smithsonian Institution, illustrates a variety of stone implements under the name of Pendants and Sinkers, which name, he says, have been given to a class of symmetrically-shaped and well-finished objects, which were evidently designed for suspension, though it is not quite certain for what special purpose they were used. On account of their shape and the pains bestowed upon their production, they have been classed among aboriginal ornaments. Yet the former inhabitants of this country devoted much time and labor to the manufacture of objects of a useful character, and hence it appears not improbable that the articles in question were, in part at least; weights for fishing lines.

After a short description of a number of the implements figured, ascribing to them several uses, such as net sinkers or weights, ornaments or amulets and perforated net sinkers, he says, in reference to net weights (page 27): "Some are roundish stones of various sizes, either worked or left in their natural state, and grooved around the middle for fastening the strings or thongs by which they were connected with the nets. It is not always easy to distinguish specimens of this description from grooved hammer-heads." C. C. Abbott, in Vol. VII, "Reports of U. S. Geological Survey West of the One Hundredth Meridian," suggests the possibility of some of the so-called "plummets" having been encased in skin and fastened to a flexible handle, thereby making a war club that, properly wielded, would have been a formidable weapon.

"In the absence of all information that might throw light on its use, we consider it best to class this specimen (referring to his Fig. 66), although wanting the all-important groove, with the preceding plummet-shaped stones."

On page 195, of the same report, a photograph of a series of "weights" collected by Mr. Schumacher in various localities of California is mentioned. The specimens are all labelled "spindle-whorls" or "weights for distention of thread." On the same page is figured a specimen of a roughly ground implement made from a fragment of coral rock, apparently pecked or hammered into shape. This is also called a "weight."

In a note by F. W. Putnam, on pages 196 and 197 of same report, mention is made of "numerous articles of stone, which there seems to be little doubt were used as sinkers, and by their shape are allied to the implements Dr. Abbott has described on the preceding pages. Two of these are of great interest, as they still show the method by which they were fastened to fishing nets or lines - - - - by means of asphaltum. This asphaltum has preserved a portion of the twine which was around each end of the stone, and it is evident that in this way the string was held in place on the sinker, which was thus easily attached to the line or net."

The most recent article on this subject, and which probably comes the nearest to giving the explanation of the uses of these implements, is by H. W. Henshaw, published in the "American Journal of Archæology," in which article, besides giving a synopsis of the various theories advanced by different writers he gives as he claims "a direct and circumstantial account of their use," which he obtained from the Santa Barbara Indians.

Mr. Henshaw, in commenting upon Mr. Henderson's article in the "American Naturalist," says: "In reference to the fourth possible use given in said article, (viz, sacred implements), that it is only a possibility, there being no evidence whatever from which to draw such an inference." Though admitted to be but a guess, it is remarkable how accurate it proves to be, for in this paragraph we have exactly the use of these plummet-like stones as explained by the Santa Barbara Indians. "The moment these stones were shown to these Indians I was told that they were medicine or sorcery stones."

"The sorcerer arranged twenty of these stones, the proper number, in a circle, pushed them violently together, sprinkled water over them and smoke issued from them. - - - At San Buenaventura substantially the same account was received. Here it was said twelve was the number required by the medicine men, exclusive of a center stone of different character. The center stone shown to me, called Tu-cait, is a flattish round, beach-worn pebble of quartzite, unworked, and stained black with iron. It was, as I was told, a peculiar power in rain making, and as an evidence of its power, the Indian held it for a few moments tightly grasped in his hands, when moisure was visible on it, caused by contact with the moist hand."

The moisture was pointed to as visible evidence of its rain-making power.

The use of the medicine stones among the San Buenaventura Indians was as follows:

The twelve sorcery stones were arranged in a circle close together; in the center was arranged the *Tucait; Chia*, the generic name for seed-meal,* together with down from the breast of the white goose, was then spread over the stones, and then red ochre spread over the whole. Around this a dance was held, while three old men sang, keeping time with rattles.

This or similar ceremonies were observed for curing the sick, bringing rain, putting out fires in the mountains, calling fish up the streams, and when war was to be made.

Several other stones of various shapes were shown to me, some in their natural condition; one a piece of iron-pyrites, another resembling a natural concretion.

Those of the third class were fashioned with care and were about 4 inches long, somewhat tapering in shape and encircled with several rings; to all of these mysterious properties were assigned, and it is probable that many other kinds were formerly in use. As nearly as could be gathered, the pear-shaped "sinker" variety was considered the most efficient in sorcery.

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* Salvia Columbariæ, *Benth*, (Mrs. Bingham.)

Why the sorcery stones were given their peculiar shape it is not easy to understand, and the solution of this problem must be left to the final consideration of those more ingenious in such speculations than the writer.

J. P. McLean, in the "Mound Builders," on page 163, figures an implement of hematite which he classes under the head "pendants," and remarks: "It may have been used as a plummet or net sinker."

In the year 1885, Mrs. Packard, a visitor to Santa Barbara, discovered an interesting relic in the old Indian burial-ground at Dos Pueblos, about 18 miles west from Santa Barbara, near the coast. This relic, one of the so-called "plummets," is made of specular iron ore. (See Fig. 29.) This, so far as my observation goes, is the first of the kind found on this coast; it resembles a specimen of the same material found near Quincy, Ill., figured on page 232 of Abbott's "Primitive Industry."

I know of no ore of this character having been found in this part of the country, and it is my opinion that the greater portion of the *charm stones* found on or near the coast were manufactured by tribes living in the interior, and were articles of barter obtained from tribes who excelled in making the finest and most potent charms.

Fig. 8 represents an implement found in Napa County, Cal., and is made of auriferous slate containing a streak of free gold; it had probably been brought from the Sierra Nevada Mountains, and I have noticed that the greater portion of the charm-stones found appear to be made of rocks *not* found in the localites where the implements were used, and the fact that many of them are of fine workmanship and rare material would go to show that they were not used for ordinary purposes.

During the past twenty years the writer has at various times endeavored to ascertain from the aborigines the uses to which the so-called plummets or sinkers were originally put.

Most of the investigations in this line have been made in the central and northern portions of California, and the conclusions arrived at are that in *those* localities they were not used as sinkers or plummets.

Mr. Henshaw says: "On calling the attention of an Indian to the ring pecked near the extremity of one of the medicine stones, he said he did not know its purpose, but that the stones so encircled were considered to be more potent than the others. In reply to my question, 'Why such a stone could not be used as a sinker to a fishing line?' a Santa Barbara Indian replied that he never saw one used in this way, and added, of his own accord, 'Why should we make stones like that, when the beach supplies sinkers in abundance? Our sinkers were beach stones and when we lost one we picked up another.'"

In "Ilios, City and Country of the Trojans," by Dr. Henry Schliemann, 1880, which I have just been reading, page 436, is figured a "perforated object of green gabbro rock, probably a weight," which closely resembles some of our perforated charm stones, and on page 437 several ' sling-bullets of hematite or loadstone," which the author remarks, "are all well polished, and with the rude implements which the Trojans had at their disposal, it must have been tremendous work to cut and smooth hard stone into the cylindroid shape of the pellets before us."

In fact, labor must have had very little or no value at that time, for otherwise it is impossible to imagine that whole months should have been wasted on the manufacture of one bullet which was lost as soon as it was slung. It will be seen that Dr. Schliemann uses the same argument in relation to the uses of these implements that the writer used in the first writing of this article several years ago, relative to the use of charm stones as ,'sling-shots or weights for fishing nets or lines."

He also refers to several such bullets in the British Museum from Assyria and Camirus, made of hematite, loadstone, and granite.

Having given the various theories which have been advanced by different writers on this subject, we will proceed to take up and consider the six different uses which might have been made of these implements.

(1) *As sling-shots.*—It is not probable that the Indians would have spent so much time and labor in the manufacture of these implements for such purposes when the beds of streams and other places would furnish abundance of water-worn pebbles.

The Indians of Lake County, Cal., now manufacture balls of clay, sun-dried, which as sling-stones furnish very effective missiles for killing ducks and other small game.

Stones intended for use as sling-stones would probably have been made of more uniform size and shape, whereas the so-called plummets are remarkably variable in these particulars, for in this State the artists seem to have taxed their ingenuity in making each and every one different in form from all the others, as scarcely any two are exactly alike, as may be seen in Fig. 13, which shows the spheroid shape of one extreme, and Fig. 6 the spindle shape of the other extreme, between which all imaginable forms and variations occur.

Figs. 1 or 6 would not be convenient, or, in any case, practical implements for such purposes.

(2) *As sinkers for fishing tackle.*—The arguments used against the probable use of these implements as sling-stones will apply with the same force against their use as sinkers. Stones which would answer the purpose equally well can be picked up when wanted for use, and it is not probable that they would have burdened themselves with extra weight while traveling from place to place.

(3) *For playing some game.*—The varied forms of these implements preclude the probability of their havbeen used for such purpose, as all games requires pie-

ces of more or less similarity of form and size, while, as before stated, it is rare to find two of the same size or shape, and the localities in which they are usually found are not places where games would have been played.

(4) *As sacred implements in the performance of some religious ceremony.*—This theory is the nearest approach to the true use of these implements.

(5) *As personal ornaments.*—This theory is unreasonable and requires no further refutation than that their weight and size would preclude such uses. They were sometimes suspended about the person for purposes to be shown hereafter.

(6) *As plummets and levels.*—This theory is still more far-fetched and untenable than the last, so far as California Indians are concerned. Tribes that build no dwellings other than temporary huts, and hastily constructed at that, would certainly have no more occasion to use plummets and levels than a wild Hottentot. These so-called plummets are nearly always found in low, marshy places near creeks, along the sea shore, and among the wild, rocky recesses of the mountains.

These localities would hardly be selected as places to erect permanent buildings, even if they had ever had the knowledge of such. Again, these so-called plummets would not have been used for the purpose some have claimed, that is, suspended by a string and used to determine perpendicular lines. They are not the form most convenient for this purpose, and if suspended by a string would not hang perpendicularly.

Implements like Figs. 1, 8 and 10 might have been used for such a purpose, providing the lower ends had been pointed, which they are not. One like Fig. 9 would have answered the purpose had it been perforated at the top.

In reference to Prof. F. W. Putnam's note to Mr. Henderson's article, I am sorry to differ with so learned an antiquarian writer as my esteemed friend, but certainly none of his theories will fit our California Indian habits and customs.

He accepts some theories which we have already discussed, with the additional one that they were used as spinning weights. This we can easily dispose of, as the Indians of this locality used no textile fabrics that required spinning or weaving, their toilet being less elaborate than that of the Georgia militia colonel, which consisted of epaulets and a paper collar.

When not nude, the Indians used skins of wild animals for clothing, or tules tied in rows on strings of sinew or bark, worn as aprons or skirts.

As to these implements being used as pestles, there are very few of the so-called plummets that could have been used for such a purpose. It is generally an easy matter to distinguish between the two, and reference to Figs. 5, 6, 7, etc., will show that they could not be mistaken for pestles, as the lower end is generally pointed.

Fig. 1 is perhaps the oldest known specimen of this class of implements. It was found with several other curious and unique implements under Table Mountain in this State, and under some 200 feet of basalt. It was made of a translucent carbonate of lime finely finished.

In a "Catalogue of A Collection of Minerals of A. Dohrmann," published by S. H. & H. Chapman, of Philadelphia, 1886, we find "No. 1134, slung shot or sinker, described as an oval stone, with deep groove around the edge; limestone, found 30 feet below the surface in a gravel bed, Camptonville, Yuba County, Cal., No. 1135, plumb-bob; shape same as those used by masons, pierced and grooved at end; serpentine; perfect and very rare; found in Alameda County, 40 feet below the surface."

Having endeavored to show what these implements were *not* used for, we will try to show what their real use was.

The majority of surviving Indians do not seem to know anything about them. One reason for this is that they had superstitious notions that these stones were dangerous and that the sight of them would cause death. Another weighty reason was, that the missionaries used their utmost endeavors to eradicate the use and knowledge of all their traditions and religious ceremonies.

About twenty years ago the writer had an opportunity to interview a very old Indian chief, named Constancio, one of the two survivors of the tribe of Napas, who formerly occupied the territory lying on both sides of the Napa River. He was quite intelligent and told me that he was about five years old when he was brought to the Mission of San Jose, then newly built. (This Mission was established in 1797). He called the plummet shaped stones *Chi-la*, and said that they were found running in the ground (that is burrowing under ground), before they are captured.

When they caught one they gave it four raps with a stone to kill it, and to prevent it paralyzing its captors. afterwards it was used as a Charm Stone. A string was tied around it and it was carried in a medicine bag; when used it was suspended by a cord from the end of a pole, one end of which was stuck into the bank of a creek in such a manner as to leave the Charm Stone suspended over the water where they intended to fish. At other places they were suspended at points in the mountains favorable for hunting; he said he had used one himself in front of his canoe.

This will account for the asphaltum and string on the implements, which Prof. Putnam says, "shows the method by which they were fastened to fishing nets or lines."

The sinker or hammer stone, Fig. 22, he readily distinguished from the Charm Stones, and called it *Lup-poo*.

In an article on "Pre-Historic California," read before the California Historical Society at San Francisco, March 20, 1888, I advanced the theory that the majority of the Charm Stones found in Central California were manufactured by a previous race, who occupied the country before and at the time of the great volcanic outburst, which filled the existing river channels and formed the Table Mountains, destroying the animal and vegetable life; after a lapse of time, the race who re-peopled the same region discovered these relics of an older race, of whom they had no knowledge nor tradition, and ascribed to them great supernatural power.

The Napa Indians also stated that they were sometimes laid upon ledges of rocks on high peaks, with the belief that, owing to their peculiar form and some occult power which they possessed, they traveled in the night through the water to drive the fish up the creeks to favorite fishing places, or through the air to drive the land game up towards certain peaks and favorite hunting grounds.

The peculiar pear-shaped form was given them to enable them to cleave through the air and water. He also stated they were used in time of war, as they were supposed to travel about at night for the purpose of worrying the enemies of their tribe.

In a recent interview with one Rafael Solaris, the last male represenative of the Tsa-ma-la tribe, who occupied a village called Tsok-to-no Ha-moo, near the Santa Ynez Mission, Santa Barbara County, I obtained direct information which substantiates my views as to the uses of these implements. Rafael at first disclaimed any knowledge of the uses of the so-called plummets; but when shown a perforated one he recognized it and said it was worn suspended from the neck for defense, and to make the wearer impervious to arrows, and that in time of war any one biting this implement was rendered invisible to his enemies, and enabled to travel with safety.

The medicine men, after fasting one month and abstaining from the use of fatty substances, after drinking several cups of the decoction of a herb which they called Tolwach-ie, were in proper condition to make use of the charm stones. The herb is common in our mountains, and has a profusion of white flowers and spiny seed-pods. The whole plant—root, leaf and flower—is poisonous, producing an abnormal condition in the person using it.

In a still more recent interview with the last of the Tchú-mah Indians I obtained the words and translation of a song which refers to this subject.

The meter and music are Schú-may (or Chuma); the words are in the Mish-khon-a-kah, or language of the Ventura Indians. It is called *Su-to-wen-cush*,

SONG.

Ká-yu-wa-will-le
I am going to tell,
Le-le-ni-mu-stu me-sip-posh
Uneasy (is) my heart,
Su-mus-il. Ka-teush-wen
Charm stones I have not.
Lá-li-o-li-o lwen-new
I am sad.

In relation to Figs. 32 and 33, Juan de Jesus, a Ventura Indian, stated that the implements which these figures represent were *idols.* Feathers were tied on each end, the idol placed in a basket or similar receptacle in the house of the medicine man, when the people who were desirous of obtaining favors from the spirit or power attributed to the idol, threw in seeds and other offerings to the receptacle until the idol was covered up. It is needless to say the offerings were appropriated by the medicine man.

Justo, a Santa Barbara Indian, stated that the Charm Stones were sometimes arranged or scattered in various places; those without perforations were covered up, while the perforated stones were placed on the surface of the ground, and during the dance, upon the approach of the individuals who had been made holy by the ceremonies before mentioned, the perforated Charm Stones would elevate themselves on one end, to be grasped by the fortunate individuals, who thereby obtained their desire in relation to having a good year. These stones were suspended upon the person of the medicine man only during the sacred dances, except in the case of a warrior, who would hang them upon his person to render him arrow-proof. In this connection I learned that the peculiar stone implement figured in Vol. VII, Wheeler's Report, on page 215, the uses of which have been heretofore unknown, was used in the following manner:

Twenty of them were arranged in a square, five on each side; in the center was a bowl of water, beside which stood the medicine-man, with a long stone pipe shaped like a cigar, in which a herb, called *pispivate* by the Mexicans, resembling southern wood, was smoked. The smoke was first directed toward the bowl of water, then toward the stones. The people came and moistened their faces with the water in the bowl, which had been made holy by the previous ceremonies. This ceremony brought rain, caused death to enemies, and various other things.

In conclusion, the evidence which I have obtained directly from the aborigines, the localities in which the implements have been found, the materials of which they are composed, the care and labor necessary in their manufacture, the evident superstitious ideas connected with them, and the ignorance of their uses (pretended or real,) favor the conclusion that these implements were objects highly prized and religiously venerated. Had they been intended to be used for any ordinary purpose or purposes as assigned to them, the Indians would not have been in ignorance of it, nor would they have hesitated to give information concerning them.

NOTE.—The writer has recently obtained a specimen similar to *Fig.* 30, except that in the side which is flat in the form represented, it is scooped out causing it to resemble a canoe; it was found in Merced County, California, and is a very interesting addition to the series.

Other interesting additions are: Two specimens shaped like *Fig.* 17, which were found, with four others of the same shape, on the beach at Santa Barbara, in excavating where some human bones had been exposed by the action of the surf. They are made of a clear and almost transparent calcite, but had been buried so long that the surface is altered to chalk.

Santa Barbara, Cal., Aug. 1st, 1890.

CHARM STONES.—DESCRIPTIONS OF FIGURES.

PLATE I.

Fig. 1.—Represents the oldest known specimen from California, found in an old river channel under Table Mountain, Tuolumne Co., California; made of yellowish, translucent arragonite, symmetrically made and finely polished; several unique and interesting relics were found with this and they formed the subject of discussion before the Am. Assoc. for the Advancement of Science at its meeting in Chicago in 18—; original in Yale College; cast in writer's collection.

Fig. 2.—Of close grained sandstone, unfinished, Contra Costa County, Cal.

Fig. 3.—Of trap, well finished, Alameda County, Cal.

Fig. 4.—Fine grained, argillaceous brown sandstone, unfinished; Alameda or Contra Costa County, Cal. This specimen has a number of notches near the upper extremity, extending around the implement, but mis-matched; evidently intended for suspension.

Fig. 5.—Of serpentine, perforated, smoothly finished, Alameda or Costra Costa Counties.

Fig. 6.—Unique specimen of trap rock, finely made, Alameda Co., California.

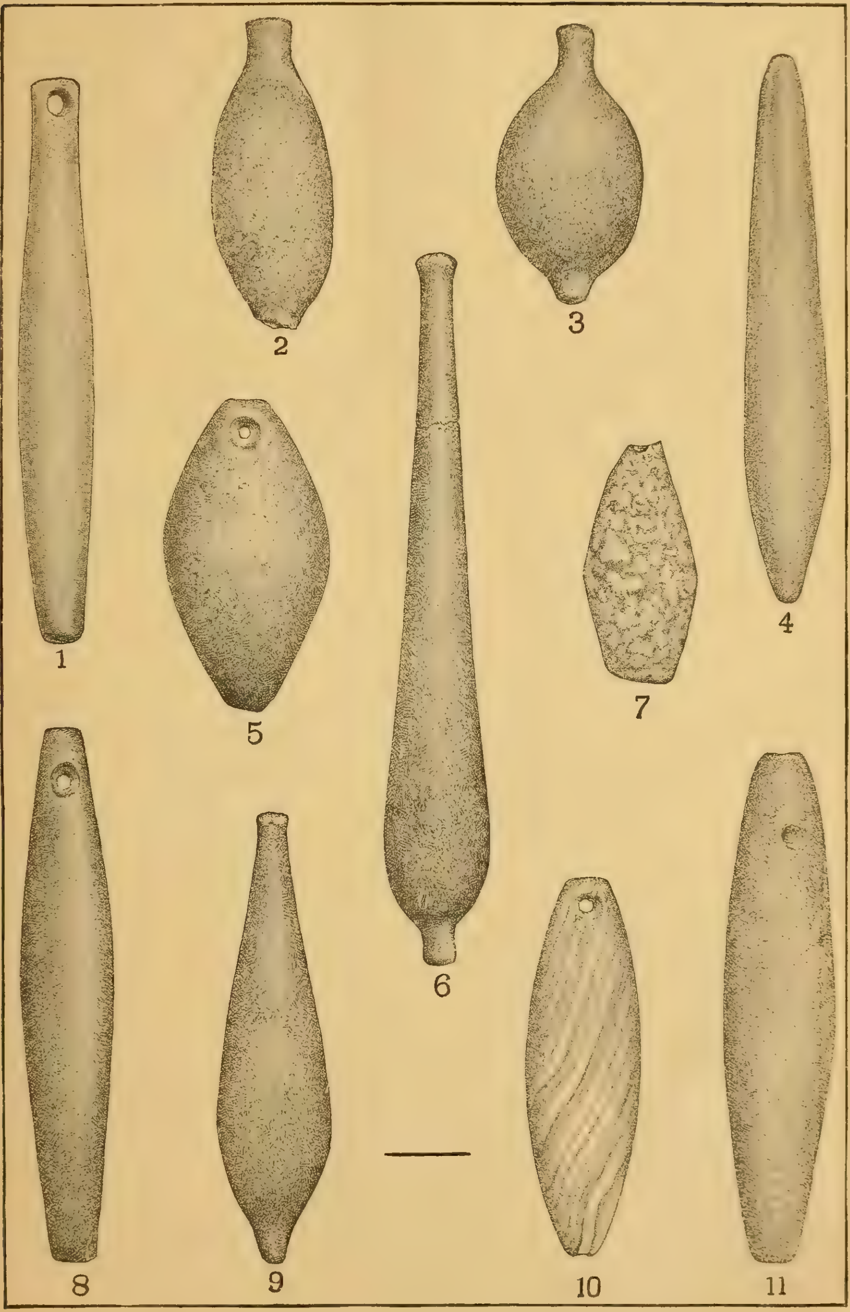
Fig. 7.—Hard, pure white magnesian rock, containing crystals of a dark mineral (serpentine?), Alameda County. This specimen is beautifully polished, but broken at both ends; the break at the upper end passed through the perforation.

Fig. 8.—Dark slaty rock, finely finished, perforated, showing free gold in considerable quantity near the upper end; Napa County, California.

Fig. 9.—Dark metamorphic rock (sandstone), finely finished with a neck at the upper end, Napa County California.

Fig. 10.—Perforated, oval in section, made of arragonite, the softer layers of the rock being weathered out by long exposure, or dissolved out by water, leaving the harder portions in projecting lines, which are much more apparent in the original than shown in the illustration.

Fig. 11.—Of very hard slate or trap, perforated, with a depression running from the perforation on one side over the top to the other side of the perforation; this peculiarity is not shown in the illustration; Napa or Contra Costa County, Cal.



Charm Stones in L. G. YATES' Collection.

PLATE II.

Figs. 12, 13, 15 and 16.—Appear to be unfinished charm stones, which when finished would have resembled Figs. 3 and 14.

Fig. 14.—A finished implement with slight groove near the upper end.

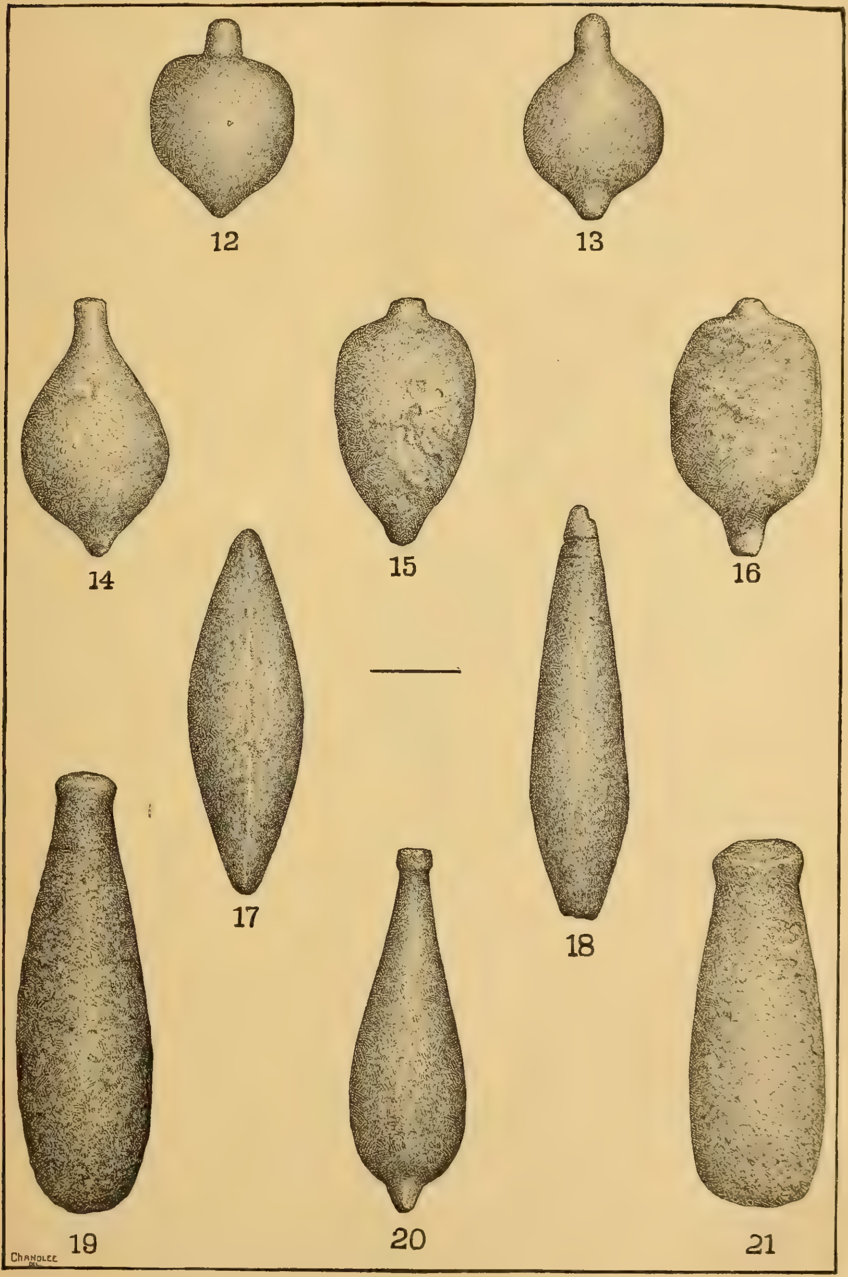
Fig. 17.—A symmetrical stone, polished, without grooves or notches.

Fig. 18.—Another finished specimen with notches to hold string, lower point broken off.

Fig. 20.—A finely finished specimen with a well defined ring-shaped head.

Figs. 19 and 21.—Pestle-shaped charm stones, which from their form would perhaps indicate their use in connection with some ceremonies relating to the collection of food.

PLATE II.



Charm Stones in L. G. YATES' Collection.

PLATE III.

Fig. 22.—A "sinker," or more probably a hammer, from Napa, California, unpolished.

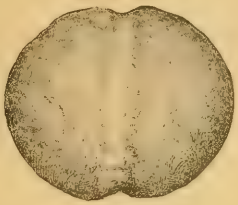
Fig. 23.—An unfinished charm stone, showing the method of working out the ends. Central California.

Fig. 25.—Finely polished, with head for attachment similar to Fig. 20. Central California.

Figs. 24 and 27.—Finely polished, originally similar to Fig. 6, from Alameda County, California.

Fig. 26.—Peculiar form, of hard slaty rock, unfinished? Alameda County California.

Fig. 28.—Of hard fine-grained rock, polished. Central California.



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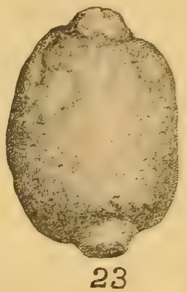

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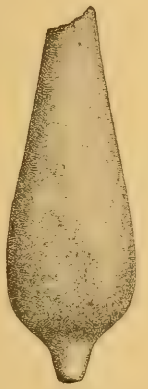

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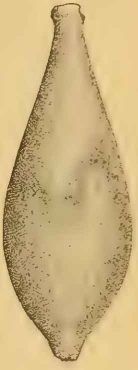

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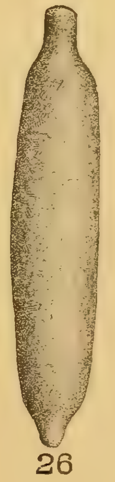

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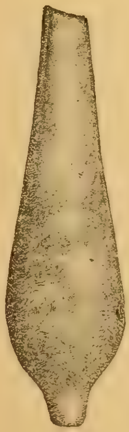

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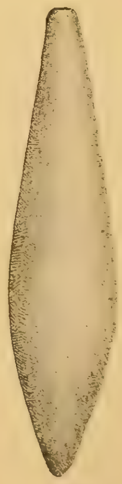

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Charm Stones in L. G. YATES' Collection.

PLATE IV.

Fig. 29.—Of Hematite, finely polished, found in Santa Barbara County, California, by Mrs. Packard, this specimen is of the same shape and material as those of the eastern United States and other countries.

Figs. 30 and 31.—Of similar material to Fig. 1, and found in the same locality. Fig. 30, entire, flattened on one side, with notches at both ends. Fig. 31, a broken portion of a similar implement, the cross sections showing a slight difference in their form.

Figs. 32 and 33.—Of hard shale, originally ornamented with feathers, used for purposes similar to those of the charm stones. From the islands near Santa Barbara, California.

Fig. 34.—Hematite, polished, from Tennessee.

Fig. *A*.—Copied from Ewbank's Life in Brazil, page 451.

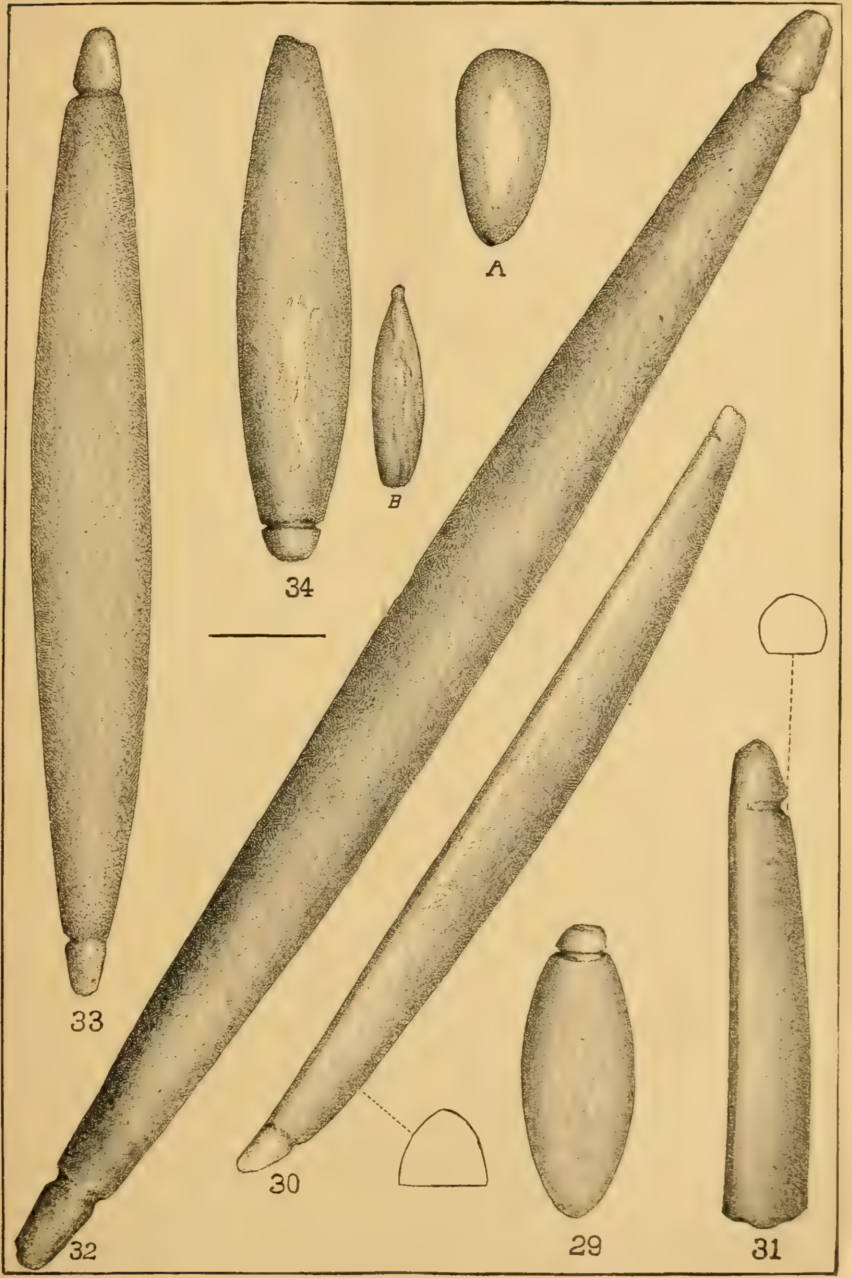
Fig. *B*.—From page 464 of the same work.

Figs. 1 to 30 inclusive, with the exception of Fig. 29, are from specimens in the writer's collection, and represent a portion only of the articles of this character contained therein.

Figs. 32 and 33 are from specimens in the collection of Mr. H. C. Ford.

Where not otherwise stated the material of which the charm stones are composed is either a hard fine-grained argillaceous sandstone, or a trap rock.

The figures are all reduced to a little less than one-half size.



Charm Stones.

THE INDIGENOUS SHRUBS OF SANTA BARBARA COUNTY.

BY PROF. H. C. FORD.

WHILE no extensive areas of this region were covered by forest growths at the advent of the Franciscan Fathers and the first settlement of the land, our mountain slopes, hillsides and a portion of the valleys were clothed with a pleasing variety of shrubs, whose numerous species and novelty must have greatly interested the early botanists who visited this coast. The varied conditions of soil and exposure found from the sea level to an elevation of 7000 feet on the main land, and 2500 feet on the mountainous islands of the Channel, renders the neighborhood well fitted for a wide range of plant life and presents a fascinating field for scientific investigation. Mountain fires and the clearing of the land for agricultural purposes has not prevented a perpetuation of the original species. Fires rarely destroy the vitality of the roots of shrubs, and a few years repairs the damage.

The mountainous district of the north eastern portion of the county is yet imperfectly examined and will no doubt yield many species not yet credited to this region.

The flora of the Channel Islands contains many species common to the main land, while many others are also found upon the more southern islands or their adjacent shores, and several have no other habitat.

I have included in the enumeration many herbaceous plants with tall stems, woody at the base, that are ranked as shrubs, and others that in favorable conditions become small trees.

Berberis repens, *Lindl.*, mountain slopes.
Berberis aquifolium, *Pursh*, Santa Ynez and San Rafael Mountains.
Berberis pinnata, *Lagasca*, main land and Santa Cruz Islands.
Romneya Coulteri, *Harv.*, Santa Ynez and San Rafael Mountains.
Dendromecon Handfordii, *Kellogg*, confined to Santa Rosa Island.
Dendromecon Californica, *Cham.*, mountain ranges.

Dendromecon flexile, *Greene*, Santa Cruz Island.
Lavatera assurgentiflora, *Kellogg*, Channel Islands, introduced to main land.
Malvastrum Thurberi, *Gray*, sides of cañons in mountain regions.
Malvastrum Thurberi, variety laxiflorum, *Gray*, Santa Cruz Island.
Malvastrum exile, *Gray*, Santa Cruz Island.
Malvastrum splendidum, *Kellogg*, Bartlett Cañon.
Fremontia Californica, *Torrey*, Alaqueda Cañon, San Rafael Mountains.
Ceanothus thyrsiflorus, *Eschscholtz*, mountain sides.
Ceanothus spinosus, *Nutt.*, throughout the county.
Ceanothus dentatus, *Torr.*, and *Gray*, dry hills near Santa Barbara.
Ceanothus hirsutus, *Nutt.*, near Santa Barbara.
Ceanothus divaricatus, *Nutt.*, throughout the county.
Ceanothus crassifolius, *Torr.*, Santa Cruz Island and mountains of main land.
Ceanothus arboreus, *Greene*, Santa Cruz Island.
Ceanothus cuneatus, *Nutt.*, common near Santa Barbara.
Ceanothus rigidus, *Nutt.*, Point Sal.
Ceanothus rigidus, *Hook.* and *Arn.*, San Rafael Mountains.
Rhamnus Purshiana, *D. C.*, Santa Ynez Mountains.
Rhamnus Californica, *Eschscholtz*, throughout the county.
Rhamnus insularis, *Kellogg*, Santa Cruz Island.
Rhus diversiloba, *Torr.* and *Gray*, throughout the county.
Rhus integrifolia, *Benth.* and *Hook.*, along the sea coast.
Rhus aromatica, variety trilobata, *Gray*, Rincon Cañon.
Rhus laurina, *Nutt.*, throughout the county.
Rhus ovata, *Watson*, Channel Islands.
Lupinus arboreous, *Sims.*, islands and main land.
Lupinus rivularis, *Dougl.*, variety latifolius, *Watson*, river bottoms.
Lupinus Chamissonis, *Esch.*, islands, common on main land.
Lupinus, Douglasii, *Agardh.*, throughout the county.
Pickeringia montana, *Nutt.*, Santa Cruz Island and San Rafael Mountains.
Amorpha Californica, *Linn.*, cañons near the sea.
Prunus occidentalis, *Lyon*, Santa Cruz Island.
Prunus demissa, *Walpers*, San Rafael Mountains.
Prunus ilicifolia, *Walpers*, common throughout the county.
Prunus Andersonii, *Gray*, sandy hiils near Purissima Mission.
Prunus emarginata, *Walpers*, San Rafael Mountains.
Rubus ursinus, *Cham.*, Santa Cruz Island and main land.
Rubus Nutkanus, *Mocino*, Summit of Tranquillon Mountain.
Nuttalia cerasiformis, *Torr.* and *Gray*, common on mountain sides.
Spirea discolor, *Pursh.*, Santa Ynez and San Rafael Mountains.
Spirea discolor, variety ariæfolia, *Watson*, near Purissima Mission.
Cercocarpus parvifolius, *Gray*, mountains of the county.
Cercocarpus parvifolius, *Gray*, var. glaber, *Watson*, Santa Cruz Isl. and main land.
Adenostoma fasciculatum, *Hook.* and *Arn.*, throughout the county.
Rosa Californica, *Cham.* and *Schlect.*, widely distributed.
Rosa gymnocarpa, *Nutt.*, mountain slopes.
Heteromeles arbutifolia, *Rœmer*, Channel Islands and main land.
Lyonothamnus asplenifolius, *Greene*, confined to Santa Cruz Island.
Amelanchier alnifolia, *Nutt.*, San Rafael Mountains.
Philadelphus Gordonianus, *Lindl.*, rare in this county.
Ribes speciosum, *Pursh.*, throughout the county.
Ribes Menziesii, *Pursh.*, islands and main land.
Ribes subvestitum, *Hook.* and *Arn.*, Santa Cruz Island.
Ribes sanguineum, *Pursh.*, throughout the county.
Ribes sanguineum, variety malvaceum, *Gray*, Santa Cruz Island.
Ribes divaricatum, *Dougl.*, Santa Ynez Mountains.
Ribes aureum, *Pursh.*, near Carpinteria.
Ribes cereum, *Dougl.*, San Rafael Mountains.
Cornus Californica, *Meyer*, banks of Santa Ynez Mountain streams.
Garrya flavescens, *Watson*, northeastern portion of the county.

Sambucus glauca, *Nutt.*, throughout the county.
Symphoricarpus racemosus, *Mich.*, common on hillsides.
Symphoricarpus mollis, *Nutt.*, islands and main land.
Lonicera hispidula, *Dougl.*, Santa Cruz Island and main land hillsides.
Lonicera hispidula, *Dougl.*, var. subspicata *Hook.* and *Arn.*, Santa Cruz Island and Rincon Creek.
Lonicera involucrata, *Banks.*, common in shady nooks.
Cephalanthus occidentalis, *Linn.*, common along streams.
Bigelovia Manziesii, *Gray*, in river valleys.
Bigelovia veneta, *Gray*, Channel Islands.
Bigelovia veneta, var. sedoides, *Greene*, San Miguel and Santa Cruz Island.
Bigelovia graveolens, var. glabrata, *Gray*, Carpinteria.
Baccharis Douglasii, *D. C.*, borders of wet tracts.
Baccharis vimnea, *D. C.*, Santa Cruz Island.
Baccharis consanguinea, *D. C.*, Santa Cruz Island.
Hazardia detonsa, *Greene*, Santa Cruz Island.
Hazardia serrata. *Greene*, Santa Cruz Island.
Senecio Douglasii, *Less.*, islands and main land.
Artemesia Ludoviciana, *Nutt.*, Santa Cruz Island.
Artemesia dracunculoides, *Pursh.*, Ellwood.
Vaccinum ovatum, *Pursh.*, pine woods, summit Santa Cruz Island,
Arbutus Menziesii, *Pursh.*, shrub on north slopes of Santa Ynez Mountains.
Arctostaphylos pungens, *H. B. K.*, dry ridges throughout the county.
Arctostaphylos tomentosa, *Dougl.*, dry hills of main land and islands.
Arctostaphylos diversifolia, *Parry*, Santa Cruz and Santa Rosa Islands.
Styrax Californica, *Tourn.*, Bartlett's Cañon.
Gillia Californica, *Benth.*, dry hills—a shrubby species.
Eriodictyon tomentosum, *Benth.*, San Rafael Mountains.
Eriodictyon glutinosum, *Benth.*, dry hills through the county.
Penstemon cordifolius, *Benth.*, coast mountains and Santa Cruz Island.
Penstemon leucanthus, *Greene*, San Rafael Mountains.
Audibertia grandiflora, *Benth.*, lower valleys of the Santa Ynez Mountains.
Audibertia nivea, *Benth.*, dry hills of main land and Santa Cruz Island.
Audibertia stachyoides, *Benth.*, Santa Cruz Island and main land.
Audibertia stachyoides, var. revoluta, *Brandegee*, Santa Rosa Island.
Audibertia Palmeri, *Gray*, Santa Cruz Island.
Audibertia polystachya, *Benth.*, dry hills.
Trichostema lanatum, *Benth.*, rocky hills.
Corylus rostrata, Ait, var. Californica, *A. D. C.*, summit of La Ttinta Mountain.
Myrica Californica, *Cham.*, cañons near Point Concepcion and Carpinteria.
Salix longifolia, *Muhl.*, Santa Cruz Island and main land.
Salix flavescens, *Nutt.*, Ellwood.
Salix Sitchensis, *Sanson*, Ellwood and De la Cuesta Cañon.
Quercus dumosa, *Nutt.*, dry slopes of island and main land hills.
Quercus parvula, *Greene*, north slopes of Santa Cruz Island.
Juniperus Californicus, *Hook.*, mountains of the interior.
Euphorbia misera, *Benth.*, near the sea.
Ephedra Nevadensis, *Watson*, saline districts of the interior.
Aplopappus cuneatus, *Gray*, San Rafael Mountains.
Aplopappus ericoides, *Hook.* and *Arn.*, dry hillsides.

THE EUCALYPTUS AND THE HONEY BEE.

BY R. F. BINGHAM.

DURING the past month or two, my attention has often been called to the great numbers of honey bees daily visiting a Eucalyptus globulus in bloom near my house, when the weather will permit. I presumed they were collecting the pollen of which it affords quite an abundant supply, never having heard it spoken of as a honey producing tree. More recently however, I have observed, in the early morning hours and late in the afternoon, scores of humming birds, and in several instances hundreds of them in the tree, and others continously coming and going, visiting every blossom.

The idea then flashed upon my mind that there must be something besides pollen to attract so many birds and bees to the tree, knowing that the humming bird feeds upon nectar, and not pollen; which upon investigation I found to be what they were after in this instance.

With a common hand lens, I find the disc of the flower, which is half an inch in diameter, completely covered with globules which upon tasting I discovered to be honey of very fair quality. It had a little of a resinous taste but certainly I should say not more, if as much as the Hemizonia fasciculata (common Tar weed). I notice also that the humming birds occupy the tree from early dawn until it becomes sufficiently warm for the honey bee to come in and assert her claim to a portion of the delicious beverage, which they are not slow to do, coming in great numbers. The birds then almost to a unit vacate, and give their more numerous aggressors full possession.

I observe too that when it is too cool or unpleasant for bees to work, even if quite rainy, the birds are out in great numbers, and continue their operations until quite late after sunset showing that the supply is continuous. Bee-keepers and others interested in tree planting, should note this and regulate their operations accordingly.

The fact that it produces a great amount of honey is evident from the numbers of bees and birds that visit it daily. Then coming into bloom as it does in the winter months without any reference to climatic surroundings,and continuing in bloom so long, it would seem that it might be a great acquisition to the resources of the apiarist, if more largely planted; particularly would it be so in the dry years when they lose their stands by hundreds from starvation. In favorable seasons when an abundant supply of honey of a better quality is produced, it would be rejected, the same as others of a poorer quality. Bees are good judges of honey and discriminate closely and seldom if ever, collect a poor quality when a better is obtainable.

The flower of the eucalyptus, including its honey secreting properties, is quite an interesting study, as I find upon close observation from day to day. The calyx is woody like the cup of an acorn; instead of separating into valves as in ordinary flowers, it divides transversly, and the top comes off like the cover of a box; it has no corrolla and the stamens are folded down with the anthers in the base of the style. About maturity they begin to expand and force the lid off from the calyx and the anthers very soon divest themselves of pollen, but its own stigma is not ready yet to become fertilized. Thus calyx No. 1, opens and the bee soon finds its way to the sweets contained upon its disc, which it visits from time to time, and in a few days calyx No. 2 on the same stem shuts its cap, and as soon as the anthers begin to open out, the bee finds its way to a fresh supply of nectar and in so doing becomes dusted with pollen. By this time the stigma, in blossom No. 1, is sufficiently mature to become fertilized. The stamens are expanded and the pollen gone, the bee coming from calyx No. 2, dusted with pollen in its attempt to get the honey from No. 1, rubs some of the pollen upon its stigma, thereby fertilizing it, and thus the operation goes on as they open at intervals of a few days, along the branch from the base upwards. In that way fertilization becomes general throughout the tree. This is one of the instances where a flower cannot be fertilized by its own pollen.

From my own observation I am under the impression that the honey secreting process continues in an individual flower for many days, probably two weeks or more. When the flowers are inaccessible to honey seekers honey collects upon the disc of the same in quantity sufficient to drip, as I have observed in some instances.

MEDICINAL PLANTS

Growing Wild in Santa Barbara and Vicinity.

BY MRS. R. F. BINGHAM.

IT is said that in every climate plants are found that possess properties of efficacy in counteracting the diseases incident to the climate, a statement probably founded on the fact that local remedies are known and used everywhere.

It is well known that most tribes of Indians have their "Medicine Men," and that a knowledge of their remedies has passed by tradition from generation to generation.

It is the object of this paper, to bring together, (at the request of our Executive Committee,) a few facts relative to the medicinal virtues of our local flora; facts which have been gleaned from botanical works, from conversations with some of our physicians, and the native Californians.

Rhamnus Purshiana, *D. C.*, an extensively used remedial agent, is found in limited quantities in this vicinity, but grows abundantly in the northern part of the State and northward to the British boundary.

It is a shrub, sometimes attaining the height of twenty feet, somewhat similar to Rhamnus Californicus, *Esch.*, popularly known as "California Coffee," which is not considered medicinal. The bark possesses cathartic properties, and is used by a firm in Detroit, Michigan, in the manufacture of a preparation, sold under the name of "Cascara, Sagrada Cordial." This firm employes a botanist constantly, to superintend the collecting and shipping of the plant from Oregon.

Daucus pusillus, *Michx.*, a herb belonging to the Carrot family (Order Umbelliferæ:) called by the Californians "Yerba del Vibora," is a plant widely distributed, ranging from the Atlantic to the Pacific; and on this coast, from Nootka Sound to Mexico. It is very common here, from near the coast to the mountains, and is very much valued by the natives as a remedy for the bite of the rattlesnake. One of our oldest physicians stated to me that he had seen a Californian chew the plant, moisten his arm with the saliva, and then permit a rattlesnake to bite his arm, without producing swelling or any bad effect. It is usually applied in form of a poultice.

Galium aparine, *Linn.*, (Order Rubiaceæ), supposed to be a native plant, but smaller than the same plant of the Eastern States and Europe; found in large quantities in shady localities, and considered by Eastern Botanic physicians as a sovereign remedy in kidney diseases. A cold infusion is used, heat destroys its medicinal properties. Common names: "Cleavers, "Goose Grass."

The Order Compositæ, furnishes several plants which are considered medicinal. Of these Grindelia robusta, *Nutt.*, is recommended especially as a remedy for the effects of "Poison Oak," (Rhus diversiloba, *T. & G*). The fresh plant is applied, or a decoction or alcoholic infusion is used. It is found growing in our mountain cañons.

Helenium puberulum, *D. C.*, common along water courses, is used as a tonic and antiscorbutic, and also in the form of powder for catarrh. Common name, "Sneezewood;" Rosilla, of the Californians.

Matricaria discoidea, *D. C.*, used for bowel complaints.

Achillea millifolium, *Linn.*, familiarly known as "Yarrow" and probably an introduced plant, is used by the natives, in the form of poultice, for healing indolent ulcers. The fresh plant is also used for staunching blood in recent wounds.

Artemisia Ludoviciana, *Nutt.*, popularly called "Wormwood," is also recommended for effects of "Poison Oak." It grows in abundance along stream banks, and in dry open ground.

Erythræa Douglasii, *Gray*, (Order Gentianeæ), is frequently found in summer, growing just under the shade of shrubs. Like other plants of this order, it contains a bitter, tonic principle, valued for malarial diseases, and known as "Conchalagua."

Eriodictyon tomentosum,*Benth.*, (Order Hydrophyllaceæ) found on the banks of mountain streams, and used for lung diseases, but especially for diseases of the mucous membrane of the throat. The "Yerba Santa" of the Californians.

Several plants of the Order Labiatæ, are considered of medicinal value. Among these are Micromeria Douglasii, *Benth.*, the well known Yerba Buena. It is found in woods, in moist soil, and valued as a blood purifying medicine. Its pleasant odor, and delicate blue flowers make it very attractive.

Salvia Columbariæ *Benth.* (Sage) is the"Chia" of the aborigines, and grows in dry soil in the foothills of the coast range.

The seed are demulcent, and used in gastro-intestinal disorders.

The Indians roasted the seed, ground them between two stones, and used the meal for food. It is said to improve the taste of poor water, and on that account is of use to persons in crossing the deserts. It quenches thirst and lessens the quantity of water desired, sometimes in that way preventing serious illness from excessive drinking of bad water. It is valued as a poultice and the seeds are sometimes placed in the eye to form a mucilage by means of which foreign bodies may be removed from that organ.

Quantities of these seeds have been found buried in graves several hundred years old, proving that the use of the seed, reaches back into the remote past.

Marrubium, vulgare, *Linn.*, (the common hoarhound,) is abundant on road sides, and waste dry grounds, much used for coughs and lung diseases.

Triclostema lanata *Benth.*,(Black Sage) a small shrub found in the coast range and cultivated in gardens of the Californians, is valued as a stimulant.

Chenopodium ambrosioides, *Linn.*, (Order Chenipodiaceæ) a common weed in many parts of the world, is used as a vermifuge under the name of "Worm-seed."

Anemopsis Californica, *Hook.*, is the "Yerba Mansa," of the Californians. Common in swampy localities, from near the coast to the mountains.

It has a thick, strongly pungent, astringent and aromatic root stock, valued for the healing of ulcers, both of the mucous membrane, and the outer surface.

Datisca glomerata, *Benth.* and *Hook.*, (Order Datiscaceæ) is found on dry stream banks. The root is a bitter tonic known as "Durango root."

THE MOLLUSCA OF SANTA BARBARA COUNTY, CALIFORNIA.

BY LORENZO G. YATES, F. L. S., F. G. S. A.

Member of the American Association of Conchologists, &c., &c.

(For description and illustrations of new species, see subsequent article.)

THE County of Santa Barbara, from its peculiar situation, its unrivalled extent and variety of sea coast, presents an extremely interesting field for the Conchologist.

Although it does not furnish individual species in so large numbers as some of the faunal regions north and south, it does furnish a large and interesting list of specific forms, and a number of species which are rarely, if ever, found at other localities on the coast of California, and some which are restricted to our county only.

From the varied character of the coast of the main land and the islands forming the southern line of the so-called Santa Barbara Channel, many species find conditions favorable to their well being.

The Santa Barbara Channel formed by the coast of the main land on the north and the Islands of San Miguel, Santa Rosa, Santa Cruz and the Anacapas (the last named being in Ventura County) on the south, form a neutral ground upon which a large number of species of the northern and southern faunas meet or overlap; the limits herein given however, will doubtless be greatly modified or extended, as the coast becomes more thoroughly examined, and many new discoveries will also result from the same cause.

In the following list I have restricted the species known to exist within the limits of this County, to such as I have collected or examined, and those which are specified in Dr. J. G. Cooper's "Geographical Catalogue of the Mollusca," as having been found in this County, leaving out such as are doubtful or are only put down as extending from some point north of us to some other point lying south of the region under consideration; leaving it to others who may come after me to make such additions and corrections as their knowledge may enable them to do; taking this "list" crude and imperfect as it is, for a groundwork to start from, and if this object is attained, the compiler will feel that he has accomplished the purpose for which it was intended.

Any criticisms or additions to this list if sent to the writer will be gratefully received.

The arrangement is similar to Dr. Cooper's catalogue before mentioned, which was published by our State Geological Survey, and still remains the best catalogue of the Mollusca of the coast of California, and I desire to express my obligations to its learned compiler, for his kind favors in aiding me in the determination of many of the species herein recorded.

The Island of San Miguel I have not yet visited, the land shells however were collected by one of my sons, who spent some months there.

The abbreviations used are :

S. B.—for Santa Barbara and immediate vicinity.
S. R. " Santa Rosa Island.
S. C. " Santa Cruz "
S. M. " San Miguel "
M. C. " Main land Coast.
M. L. or More's L. for More's Landing.
Geog. Cat.—for Dr. Cooper's "list" above named, which is given as authority where quoted for such species as I have not seen.

In instances where species have been reported from our region by other conchologists, I have given their names in italics, and in a few cases the names of our local collectors who have obtained the species.

Lingula albida, *Hinds*, Santa Barbara at 28 fathoms.
Terebratula sp. } Dredged in the Channel by H. C. Ford and J. W. Calkins.
Waldheimia sp. }
Xylotrya setacea, *Tryon*, "Teredo."
Zirphœa crispata, *Linn.*, dead valves at More's Landing.
Pholadidea penita, *Conr.*, Santa Rosa and main land coast.
" ovoidea, *Gld.*, Santa Rosa, Santa Cruz and main land coast.
Parapholas Californica, *Conr.*, Santa Rosa, &c. This magnificent Pholad is rarely obtained in good condition, dead valves and its peculiar "chimney" are sometimes found on the beach.
Saxicava pholadis, *L.*, Santa Rosa I., &c.
Glycimeris generosa, *Gld.*, S. R. and More's Landing.
Platyodon cancellatum, *Conr.*, " "
Cryptomya californica, *Conr.*, S. R. and M. C.
Schizothærus, Nuttalli, *Conr.*, S. R., dead valves on beach at S. B. and M. L.
Neæra pectinata, *Cpr.*, S. B. (*Newcomb.*)
Clidiophora punctata, *Conr.*, S. B. (" and Ford.)
Thracia curta, *Conr.*, S. R. and More's Landing.
Cyathodonta undulata, *Conr.*, (Geog. Cat.)
Lyonsia californica, *Conr.*, S. B. and coast.
Entodesma saxicola, *Baird*, S. R. (Southern limit.)
Mytilimeria Nuttalli, *Conr.*, S. R. and M. C.
Solen sicarius, *Gld.*, S. R. and S. B.
" rosaceus, *Cpr.*, More's Landing.
Solecurtus californianus, *Conr.*, More's Landing, &c.
" " *var.* subteres, *Conr.*, M. C. ?
Machæra patula, *Dixon*, (Ford.)
Sanguinolaria Nuttalli, *Conr.*, M. C. on beach.
Macoma secta, " " " " "
" yoldiformis, *Cpr.*, S. R. Island.

Macoma nasuta, *Conr.*, Santa Rosa Island and M. C.
" inquinata, *Desh.*, (Southern limit.)
" inconspicua, *Br.* and *Sby.*, (Southern limit) on kelp roots.
Mera modesta, *Cpr.*, (Newcomb.)
Tellina Bodegensis, *Hds.*, S. R. Is. and S. B.
" bimaculata, *Linn.*, on Anacapa Is., about 4 miles distant from S. C. Is., (Northern limit.)
Cooperella scintillæformis, *Cpr.*, (Geog. Cat.)
Lutricola alta, *Conr.*, S. R. and M. C. (Northern limit.)
Semele decisa, *Conr.*, More's Landing " "
" rupium, *Sby.*, (Newcomb.)
Cumingia californica, *Conr.*, common in roots of kelp.
Donax californicus, *Conr.*, M. coast.
" flexuosus, *Gld.*, (Geog. Cat.)
Standella planulata, *Conr.*, S. R. (Northern limit.)
" falcata, *Gld.*, dredged in Channel (Southern limit.)
Amiantis (Callista) callosa, *Conr.*, rare.
Tivela crasatelloides, *Conr.*, (the "Big Clam") S. R. and M. C.
Psephis tantilla, *Gld.*, S. R. and elsewhere.
" Lordi, *Baird ?*
Meretrix toreuma, *Gld.*, (Geog. Cat.) northern limit.
Venus (Chione) simillima, *Sby.*, S. R. Is. and M. C.
" " succincta, *Val.*, " " (northern limit.)
" Fordii, *L. G. Yates*, (n. sp.), one live specimen dredged in Channel.
Tapes tenerrima, *Cpr.*, More's Landing.
" staminea, *Conr.*, S. R. and M. C., common.
" " *var.* diversa " " "
" " " orbella, *Cpr*,, in cavities of rocks.
Saxidomus gracilis, *Gld.*, S. R. Is. and M. C.
" Nuttalli, *Conr.*, " " "
Rupellaria lamellifera, *Conr.*, islands and M. C.
Petricola carditoides, *Conr.*, S. R. and M. C.
Chama exogyra, *Conr.*, " " "
" pellucida, *Sby.*, " " "
" spinosa, *Sby.*, " " "
Cardium corbis, *Mart.*, " " " (Southern limit.)
" quadragenarium, *Conr.*, " " "
" blandum. *Gld.*, " " "
Liocardium elatum, *Sby.*, " (Northern limit.)
" substriatum, *Conr.*, M. C.
" *var.* major, (*var. nov.*) M. L., a much larger and more handsome shell than the type.
Venericardia borealis, *Conr.*, *var.* ventricosa, *Gld.*, (Geog. Cat.)
Lazaria subquadrata, *Cpr.*, S. R. Isl. and S. B.
Lucina californica, *Conr.* " " "
Diplodonta orbella, *Gld.*, S. R., S. B. in holes in rocks.
" " *var.* " " " "
Kellia Laperousii, *Desh.*, " " " "
" suborbicularis, *Mont*, S. R. Island.
Lasea rubra, *Mont.*, S. B. at Castle Rock in byssus of Septifer bifurcatus.
Mytilus californianus, *Conr.*, common.
" edulis, *Linn.*, less "
" (septifer ?) bifurcatus, *Stearns.*
Septifer bifurcatus, *Rve.*, islands and M. C.
Modiola capax, *Conr.*, (Geog. Cat.) Northern limit.
" modiolus, *Linn.*, S. B. Island (Southern limit.)
" recta, *Conr.*, (*Newcomb.*)
Adula falcata, *Gld.*, S. R. and M. C.
" stylina, *Cpr.*, M. C., (*Newcomb.*)
Lithophagus plumula, *Hanl.*, S. R. and M. C.

Barbatia (Arca) gradata, *Sby.*, S. B. (Northern limit.)
Axinea intermedia, *Brod.*, S. R. Island.
" septentrionalis, *Midd.*, fossil at S. B., living on S. R. Isl., (Southern limit.)
Nucula tenuis, *Mont.*, (Geog. Cat.) Southern limit.
Verticaria ornata, *D'Orb*, (Geog. Cat.), only locality in America.
Philobrya setosa, *Cpr.*, (Geog. Cat.), Northern limit.
Leda hamata, *Cpr.*, in roots of kelp at S. B.
Lima dehiscens, *Conr.*, " " " "
Pecten hastatus, *Sby.*, S. R. and M. C. (Southern limit.)
" " *var.* Hindsii, *Cpr.*, S. R. (Southern limit.)
" paucicostatus, *Cpr.*, (Geog. Cat.), Northern limit.
" æquisulcatus, *Cpr.*, common.
" latiauritus, *Conr.*, S. R. Isl. and M. C.
" monitimeris, *Conr.*, M. C., occasionally abundant.
Janira dentata, *Sby.*, M. C., (*Newcomb*).
Hinnites giganteus, *Gray*, S. R. and M. C. at Sta. Barbara.
Ostrea lurida, *Cpr.*, S. R. and M. C.
" conchaphila, *Cpr.*, M. C. ?
" " var. rufoides, *Cpr.*, (*Newcomb*).
Placunanomia macrochisma, *Desh.*, not common.
Anomia lampe, *Gray.*; rare.
Bulla nebulosa, *Gld.*, (Geog. Cat.), Northern limit.
Haminea vesicula, *Gld.*, sometimes abundant in estuaries.
Tornitina carinata, *Cpr.*, (Geog. Cat.), Northern limit.
" cerealis, *Gld.*, Coast of mainland.
Volvula cylindrica, *Cpr.*, (Geog. Cat.), only locality.
Neaplysia californica, *Cooper.* quite common on M. C. near S. B. in May, 1890.
Doris albopunctata, *Cooper*, S. B. at 20 fathoms (*Cooper.*)
Dendronotus iris, *Cooper*, in the Channel, on kelp.
Cabrilla occidentalis, *Fewkes*, new genus from S. C. Is., only known locality.
Æolis barbarensis, *Coop.* (Geog. Cat.), Santa Barbara, only locality.
Phidiana iodinea, *Coop.*, rare at S. B., found at Carpinteria by Mr. I. B. Hardy.
Chioræa leontina, *Gld.*, (Dr. J. W. Fewkes in Bull. of Essex Inst., Vol. 21, 1889), the Chioræra leonina, *Gld.*, of the Geog. Cat. Tryon gives it as Chiorhæa leonina, *Gld.*; Gould's original description and Dr. Cooper agree in the spelling; one specimen dredged in the Channel at 20 fathoms by Dr. Cooper.
Ariolimax columbianus, *Gld.*, quite common in El Montecito (Southern limit.)
Limax sp. ? abundant in El Montecito
Succinea rusticana, *Gld.*, Santa Rosa Island.
Helix Ayresiana, *Newc.*, restricted to Channel Islands.
" Traskii, *Newc.*, main land only.
" " *var.* approaching H. Ayresiana, found near Point Concepcion by Albert E. Yates. Dr. J. G. Cooper, in his "West Coast Pulmonata," (see Bulletin of the California Academy of Sciences, Volume 2, No. 7), says of his shell: "Near Point Concepcion, Dr. Yates obtained a form of large size, but with nearly the same dark color as that of *H. Dupetithouarsi*, combined with the sculpture of *H. Traskii.* It has in fact nearly the same size and form as the figure of the former copied by Binney from Deshays, but which was described as colored like *H fidelis.*"
" tudiculata, *Binn.*, rare in this county.
Melampus olivaceus, *Cpr.*, abundant in estero near More's Landing.
Physa D'Orbigniana, *Lea*, Santa Rosa Island, living and fossil.
" Traskii, *Lea*, streams on main land.
Dentalium hexagonum, *Sby.*, Santa Barbara and South (Northern limit.)
" indianorum, *Cpr.*, " Rosa Island (Southern limit.)
Chiton (Mopalia) muscosa, *Gld.*, Santa Rosa Island and M. C., common.
" (Acanthopleura) scabra *Rve.*, common.
" (Ischnochiton) Magdalensis, *Hds.*, Santa Rosa Island.

Chiton (Ischnochiton) Cooperi, *Cpr.*, Santa Rosa Island and M. C.
“ sp., El Rincon.
Nacella incessa, *Hds.*, Santa Rosa Island and main land coast.
“ depicta, *Hds.*, (Geog. Cat.) Northern limit.
“ paleacea *Gld.*, on “sea grass” (Southern limit.)
Acmæa patina, *Esch.*, islands and main land coast.
“ persona, *Esch.*, “ “ “ “
Acmæa asmi, *Midd.*, islands and main land coast.
“ scabra *Nutt.*, “ “ “ “
“ spectrum, *Nutt.*, “ “ “ “
“ crebrifilatum, *Cpr.*, Santa Rosa Island.
“ “ *var.* “ “
“ (Scurria) mitra, *Esch.*, islands and main land coast.
“ (Lottia) gigantea, *Gray*, “ “ “
Gadenia reticulata, *Sby.*, (Rowellia radiata, *Cooper*), islands and M. C.
Fissurella volcano, *Rve.*, “ “
“ (Glyphis) aspera, *Esch.*, “ “
Lucapina crenulata, *Sby.*, rare, “ “
Fisurellidæ (Clypidella) bimaculata, *Lall.*, “ “
Haliotis Cracherodii, *Leach.*, abundant, “ “
“ corrugata, *Gray*, islands, rare, (Northern limit.)
“ rufescens, *Sw.*, “
Phasianella compta, *Gld.*, Santa Rosa Is. and main land coast (Northern limit.)
“ “ *var.* pulloides, *Cpr.*, Santa Rosa Island and main land coast.
Pomaulax undosus, *Wood.*, islands and main land coast.
Leptothyra sanguinea, *Cpr*,, Santa Rosa Island and main land coast.
“ bacula, *Cpr.*, “ “ “ (Northern limit.)
“ “ *var.* “ “ “
Trochiscus Norrisii, *Sby.*, islands and main land coast. (Northern limit.)
Chlorostoma funebrale. *A. Ad.*, islands and main land coast.
“ “ *var.* subapertum, *Cpr.*, Santa Rosa Island.
“ brunneum, *Phil.*, islands and main land coast.
“ Pfeifferi, *Phil.*, Santa Barbara Channel.
“ aureotinctum, *Fbs.*, Santa Rosa Isl. and M. C. (Northern limit.)
“ gallina, *Fbs.*, islands.
Calliostoma canaliculatum, *Mart.*, Santa Rosa Island and main land coast.
“ costatum, “ “ “
“ annulatum, “ “ “
“ gloriosum, *Dall.?* main land coast.
“ gemmulatum, *Cpr.*, Santa Rosa Island. (Northern limit.)
“ splendens, *Cooper*, “ “
“ tricolor, *Gabb.* “ “
Gibbula parcipicta, *Cpr.*, (Geog. Cat.) Southern limit.
Margarita acuticostata, *Cpr.*, Santa Rosa Island and M. C. (Southern limit.)
Galerus contortus. *Cpr.*, (Geog. Cat.)
Crepidula aculeata, *Gmel.*, main land coast.
“ dorsata, *Brod.*, *var.* lingulata, *Gld.*, Santa Rosa Island and M. C.
“ adunca, *Sby.*, Santa Rosa Island, main land coast.
“ excavata, *Brod.*,
“ rugosa, *Nutt.*, main land coast. (Southern limit.)
“ navicelloides, *Nutt.*, Santa Rosa Island and M. C. (Southern limit.)
“ “ *var.* explanata, *Gld.*, (Northern limit.)
“ “ “ nummaria, “ (*Hepburn.*)
Hipponyx cranioides, *Cpr.*, Santa Rosa Island and M. C. (Northern limit?)
“ serratus, *Cpr.*, (Geog. Cat.) Northern limit.
“ antiquatus, *Linn.*, islands and main land coast.
“ tumens, *Cpr.*, “ “ “
Vermiculus, Fewkesi, *L. G. Yates* (n. sp.), one specimen found in kelp root near Ellwood by Albert E. Yates, genus not heretofore noted from California.

Serpulorbis squamigerus, *Cpr.*, islands and M. C. (Geog. Cat. gives this as Northern limit.)
Bivonia compacta, *Cpr.*, Santa Barbara. (Southern limit?)
Spiroglyphus lituella, *Morch.*, " "
Cœcum crebricinctum, *Cpr.*, Santa Barbara, 20 fathoms. (*Dr. Cooper.*)
Turitella Cooperi, *Cpr.*, (Northern limit.)
Cerithidea sacrata, *Gld.*, Santa Rosa Island and Esteros.
Vertagus Lordii, *L. G. Yates*, (new species), one imperfect specimen found with the vermiculus.
Vertagus gemmatus, *Hds.*, two specimens found on beach at Carpinteria in 1881. New to California?
Bittium filosum, *Gld.*, Santa Rosa Island and elsewhere.
" " *var.* esuriens, *Cpr.*, (*Hepburn.*)
" quadrifilatum, *Cpr.*, Santa Rosa Island and elsewhere.
" " *var.* " " " main land coast.
" armilatum, *Cpr.*, (*Hepburn.*)
" asperum, *Cpr.*, Santa Rosa Island and M. C. (Northern limit. ?)
Littorina planaxis, *Nutt.*, "Periwinkel," abundant.
" scutulata, *Gld.*, islands and main land coast.
" " *var.* (*Cooper*), Santa Rosa Island.
Lacuna variegata, *Cpr.*, islands and main land coast.
" solidula, *Loven.*, main land coast. (*Newcomb.*)
" unifasciatá, *Cpr.*, Santa Rosa Island and main land coast.
Isapis obtusa, *Cpr.*, Santa Barbara at 20 fathoms. (*Dr. Cooper.*)
Rissoina purpurea, *Cpr.*, (Geog. Cat.), Northern limit.
Rissoa acutelirata, *Cpr.*, " " "
Amphithlamus inclusus, *Cpr.*, " " "
Luponia spadicea, *Sw.*, islands and M. C. " "
Trivia californiana, *Gray*, Santa Rosa Island and main land coast.
" Solandri, *Sby.*, " " (Northern limit.)
Erato vitellina, *Hds.*, " "
" columbella, *Mke.*
Myurella simplex, *Cpr.*, rare. (Northern limit).
Drillia inermis, *Hds.*, S. R. and M. C. "
" moesta, *Cpr.*, " "
" torosa " " " (Southern limit.)
" " *var.* nitens, *Cpr.*, Santa Rosa Island. (Northern limit).
Surcula Carpenteriana, *Gabb.*, (*Hepburn.*)
Mangelia variegata, *Cpr.*, Santa Rosa Island and main land coast.
" " *var.* nitens, *Cpr.*, (Geog. Cat.), only known locality.
" angulata *Cpr.*, coll. H. C Ford. (Southern limit.)
" interlirata, *Stearns*, Santa Rosa Island.
Clathurella affinis, *Dall.*, San Miguel Island. (Proc. Cal. Acad. Sc., Volume v., page 62.)
Mitromorpha aspera, *Cpr.*, Santa Rosa Island.
" filosa, *Cpr.*, (Geog. Cat.), Southern limit.
Conus californicus, *Hds.*, islands and main land coast.
Odostomia gravida, *Gld.*, Santa Rosa Island.
Dunkeria laminata, *Cpr.*, (Geog. Cat.), Northern limit.
Chemnitzia chocolata, *Cpr.*, *var.* aurantia, *Cpr.*, (Geog. Cat.). Southern limit.
" tenuicalata, *Gld.*, Santa Rosa Island.
" crebrifilata, *Cpr.*, (Geog. Cat.), only locality.
" torquata, *Gld.*, (Geog. Cat.) Southern limit.
" " *var.* stylina, *Cpr.*, (Geog. Cat.), Southern limit.
" virgo, *Cpr.*, (Geog. Cat.), only known locality.
Eulima thersites, *Cpr.*, (Geog. Cat.), Southern limit.
Scalaria tincta, " Santa Rosa Island and Carpinteria.
" subcoronata, *Cpr.* (*Newcomb.*)
" gracilis, *Sby.*, Channel Islands.
" indianorum *Cpr.*, (*Newcomb.*)

Opalia crenatoides, *Cpr.*, *var.*, insculpta, *Cpr.*, S. C. Is. (Southern limit.)
“ bullata *Cpr.*, (Geog. Cat.), only locality.
Cerithiopsis tuberculata, *Mont.*, Santa Rosa Island.
“ assimilata, *C. B. Ad.*, rare.
“ portior, *Cpr.*, (Geog. Cat.), only known locality.
Cancellaria Cooperi, *Gabb.?* very rare.
Lunatia Lewisii, *Gld.*, Island and main land coast.
Lamellaria Stearnsiana, *Dall*, Santa Rosa Island and main land coast.
Ranella californica, *Hds.*, islands, dredged in Channel.
Mitra maura, *Sw.*, Islands and main land coast, rare.
Marginella Jewettii, *Cpr.*, (Geog. Cat.), Southern limit.
“ subtrigona‘ “ (Geog. Cat.), Southern limit.
Volvarina varia, *Sby.*, Santa Rosa Island. (Northern limit.)
Olivella biplicata, *Sby.*, islands and main land coast, abundant.
Nassa fossata, *Gld.*, Santa Rosa Island and M. C.; not common, occasionally found living near Santa Barbara.
“ perpinguis, *Hds.*, rare.
“ mendica, *Gld.*, Santa Rosa Island and main land coast.
“ Cooperi, *Fbs.*, “ “ “
“ tegula *Rve.*, rare. (Northern limit.)
Columbella (Amycla) carinata, *Hds.*,
“ “ “ *var.* Hindsii, *Rve.*
“ “ tuberosa, *Cpr.*, rarely found living.
“ “ gausapata, *Gld.*
Amphissa corrugata, *Rve.*, islands and main land coast.
“ “ *var.*, Santa Rosa Island.
“ “ versicolor, *Dall*, Santa Rosa Island.
Purpura crispata, *Chem.*, *var.* septentrionalis, *Rve.*, (Geog. Cat.) Southern limit.)
“ canaliculata, *Ducl.*, Santa Rosa Island. (Southern limit.)
“ saxicola, *Val.*, “ “ “
“ “ *var.* fuscata, *Fbs.*, S. R. I., “
“ “ “ ostrina, *Gld.*, (Geog. Cat.) (Southern limit.)
“ “ “ emarginata, *Desh.*, Santa Rosa Island.
“ triserialis, *Blain*, (Geog. Cat.), Northern limit.
Monoceros engonatum, *Conr.*, Santa Rosa Is. and main land coast.
“ “ *var.* spiratum, *Blain*, S. R. Is. “
“ lapilloides, *Conr.*, “ “
“ paucilirata, *Stearns*, Southerly Channel Islands?
Ocinebra lurida, *Midd.*, Santa Rosa Island.
“ “ *var.* (*Dr. Cooper*), Santa Rosa Island.
“ interfossa, *Cpr.*, (*Newcomb.*)
“ “ *var.* atropurpurea, *Cpr.*, S. R. Is. (Southern limit.)
“ “ “ muricata, *Cooper*, Santa Rosa Island.
“ “ “ clathrata, *Cpr.*, “ “
“ Poulsoni, *Cpr.*, (Northern limit.)
Cerostoma foliatum, *Gmel.*, very rare, dredged alive in S. B. Channel. (Southern limit.)
“ Nuttalli, *Conr.*, Carpinteria (Hardy.)
Chorus Belcheri, *Hds.*, found in Indian Rancherias. (Northern limit.)
Nitidella Gouldii, *Cpr.*, Santa Rosa Island.
Muricidea incisa, *Brod.*, Santa Cruz Island. (Northern limit.)
“ fasceolata, *Hds.*, Santa Rosa Island.
“ barbarensis, *Gabb.*, (Geog. Cat.), Northern limit.
“ subangulata, *Stearns*, San Miguel Island only. Collected by Harford (Proc. Cal. Acad. Sc., Vol. v, p. 81.)
Trophon triangulatus, *Cpr.*, (Geog. Cat.), S, C. Is. (Northern limit.)
Siphonalia Kellettii, *Fbs.*, dredged in Channel. “
Neptunea (Chrysodomus) lirata, *Mart.*, jun.? S. B. (Southern limit.)
Fusus, ambustus, *Gld.*, (Geog. Cat.). Northern limit.
“ cinereus, *Rve.*, (F. geniculus, *Conr.*?) S. R. Is. (Southern limit.)

Anachis penicillata, *Cpr.*, Santa Rosa Island. (Northern limit.)

CEPHALOPODA.

Argonauta Argo, *Linn.*, Santa Cruz Island (Northern limit.) This species, the "Paper Nautilus" is sometimes found on the seaward side of the island in large numbers.
Ommastrephes gigas, *D'Orb.* I found two live specimens cast on the beach of Santa Rosa Island.

ADDENDA.

Since the foregoing list was sent to press and during the time of waiting for illustrations, the following additions have been made :

Periploma argentaria, *Conr.*, (Northern limit.)
Semele pulchra, *Sby.*, Santa Barbara Channel.
Mera obtusa, *Cpr.*, “ “ “
Milneria minima, *Dall.*, “ “ “ (Northern limit).
Chiton (Trachydermon) fallax, *Cpr.*, in *ms.;* dredged in channel (Southern limit.)
Leptothyra Carpenteri, *Pilsb.*, Santa Barbara Channel.
Omphalius fuscescens, *Phil.*, variety (Northern limit.)
Lacuna unifasciata, *Cpr.*, *var.*, aurantiaca, *Cpr.*, Santa Barbara Channel.
Clathurella constricta, *Gabb.*, variety, Santa Barbara Channel.
Odostomia avellana *var.*, Gouldii, *Cpr.*, (*Dr. Cooper*), S. B. Channel.
Nassa fossata, *Gld.*, well marked variety, Santa Barbara Channel.
Ocinebra lurida, *var.* aspera, *Baird*, Santa Barbara Channel (Southern limit.)

The "Scientific Results of Explorations by the U. S. Commission Steamer Albatross," just published by the U. S. National Museum, gives the following new species, which having been found "off the Santa Barbara Islands, California," in deep water may be claimed as possibly coming within the limits of the fauna of Santa Barbara County.

Venericardia barbarensis, *R. E. C. Stearns*, off Sta. Barbara Islands, California, mud at 276 fathoms depth.
Lucina æquizonata, *R. E. C. Stearns*, same locality and depth as preceding.

(Prof. W. H. Dall has described the following :)

Buccinum viridum, *Dall.*, off Santa Barbara Islands in 414 fathoms.
Chrysodomus amiantus, *Dall.*, same locality and depth.
“ griseus, *Dall.*, “ “ “ “
“ aphelus, *Dall.*, “ “ “ “
Columbella permodesta, *Dall.*, off Santa Barbara Islands in 276 fathoms.
Calliostoma platinum, *Dall.*, near the “ “ “ “ “ “
Turcicula Bairdii, *Dall.*, off San Clemente Island in 414 fathoms.
Solariella oxybasis, *Dall.*, off the Santa Barbara Islands in 414 fathoms.

NEW SHELLS FROM THE SANTA BARBARA CHANNEL.

BY DR. LORENZO GORDIN YATES, F. L. S., F. G. S. A.

Family VENERIDÆ.
Sub-family VENERINA.
Genus *Venus*.
Venus Fordii, L. G. YATES, (nov. sp.) Pl. 1. Figs. 1-5.

SHELL thick, solid, ovate, tumid, truncated at point, exterior light brown; beaks projecting to front of the shell, much elevated and curved, making more than half a turn forwards and inwards; lunule rough, much depressed, heart-shaped, bounded by an impressed line; ligament not large, but nearly hidden in the depression between the elevated beaks; surface with concentric rounded ridges and grooves, marked on the surface by minute concentric laminæ, about one third of a millimeter apart, forming a chalky covering to the shell; the entire surface of the shell is further marked by fine, but somewhat irregular radiating lines and corresponding depressions a little less than a millimeter apart; these lines are more distinctly shown on the anterior portion of the shell; margins finely crenulated; young shells are of a dirty yellowish white, and mature shells which have become divested of the chalky exterior are of a yellowish brown color, and together with the young shells are marked with four radiating rows of chocolate colored blotches.

Size of largest shell in writer's collection 2 ⅜ inches long, 2 ⅜ inches high and 2 inches in width.

I take pleasure in dedicating this shell to Mr. H. C. Ford, who has for many years presided at the meetings of our Society of Natural History.

Family CERITHIIDÆ.
Genus CERITHIUM.

Sub genus *Vertagus.*

Vertagus Lordii; L. G. YATES, (nov. sp.) Pl. 2, Figs. 6-7.

This shell at first glance might be mistaken for *Vertagus gemmatus, Hds.*, found on the west coast of Mexico, but close inspection will show that it is entirely distinct from that species.

Dr. Carpenter in "Catalogue of Collection of Mazatlan-Shells in the British Museum, collected by F. Reigen," writes of V.gemmatus: "This shell is very constant in its characters; presenting a sharp straight outline, and a sculpture of 3 rows of nodules (of which the upper is the larger) with a double spiral line between."

V. Lordii shows a sculpture of seven rows of nodules, the upper two of which are the largest and gradually decrease until the seventh row is scarcely perceptible to the naked eye; a row of indistinct nodules is apparent between the two upper rows, the spaces between all the rows of nodules otherwise occupied by fine striæ consisting of from 8 to 12 or more fine lines, each alternate raised line being larger than the intervening one; the varical ridges in the imperfect specimen found are placed one at the aperture, and one at about two thirds of the last whorl; lip more flaring than in gemmatus, a distinct pareital knob on columella near posterior angle of aperture, which running along under the junction of the whorls forms a well marked spiral line about one millimeter from the junction. Color, a uniform yellowish white. Dedicated to Mrs. F. C. Lord as a slight testimonial to her generous labors as Librarian and Curator of the Society of Natural History of Santa Barbara.

The single specimen in my collection was found in a root of kelp, together with Vermiculus Fewkesi, by my son Albert E. Yates, near Ellwood.

Family VERMETIDÆ.
Genus VERMETUS. *Adanson.*
Sub-genus *Vermiculus,* LISTER.

Vermiculus Fewkesi, L. G. YATES,(nov. sp.) Pl. 2, Figs. 8-9.

Shell consisting of a long, brown, conical tube, marked with numerous unequal raised lines along its entire length; at the pointed end is a spire of ten closely connected whorls, upon each of which is a sharp raised line below the central portion of the whorl; a less prominent raised line shows at the jointure with the next whorl below, and after the whorls seperate another and still less prominent line is seen; on the upper portion of the whorl which in the turritelloid portion of the shell is covered, or merged into the line of contact of the different whorls above, numerous fine lines are seen between, and all are crossed by distinct lines of growth; as the shell increases in size the lower raised line, instead of the central one, becomes most prominent. The turritelloid portion of the single specimen found is nine millimeters long, the aperture is circular, three millimeters in diameter, the entire length of the shell is sixteen millimeters. One specimen found near Ellwood by Albert E. Yates. This shell is dedicated to my esteemed friend Dr. J. Walter Fewkes, Secretary of the Boston Society of Natural History, as a recognition of the time and labor spent by him in the description and delineation of some of our new marine fauna.

PLATE 1

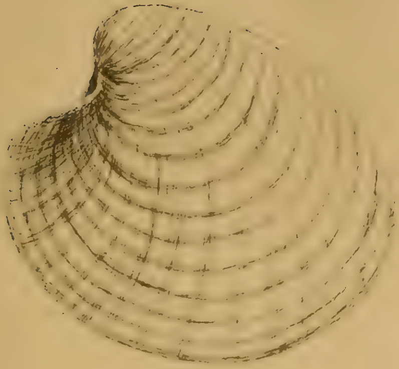
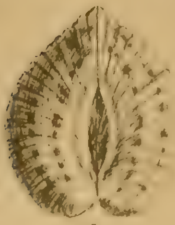


Fig.1.



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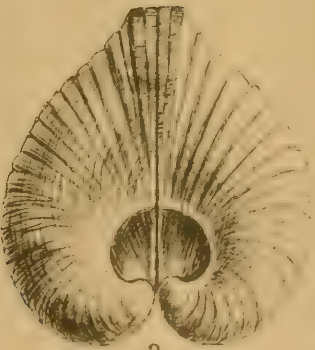

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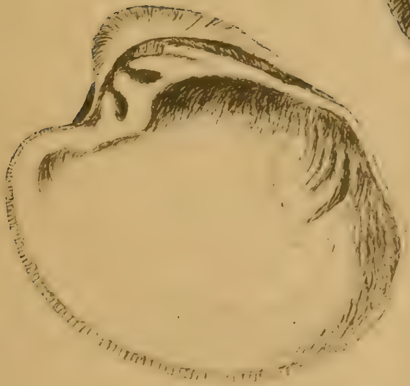

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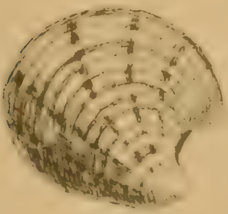

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NEW SHELLS FROM THE SANTA BARBARA CHANNEL.

Figs. 1–5, Venus Fordii, *L. G. Yates*.

Bulletin No. 2 Santa Barbara Society of Natural History.

PLATE 2.

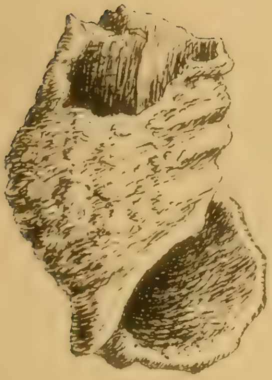
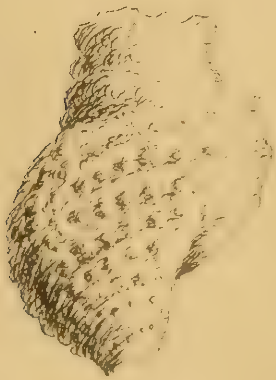


Fig. 6.



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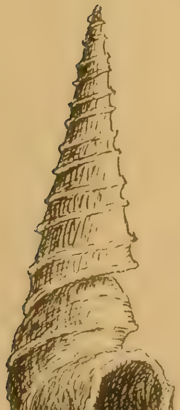

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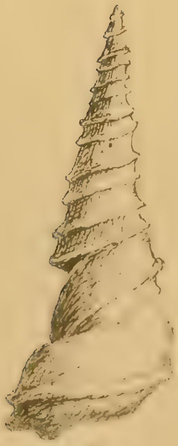

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NEW SHELLS FROM THE SANTA BARBARA CHANNEL.

Figs. 6, 7, Vertagus Lordii, *L. G. Yates.*

Figs. 8, 9, Vermiculus Fewkesi, *L. G. Yates.*

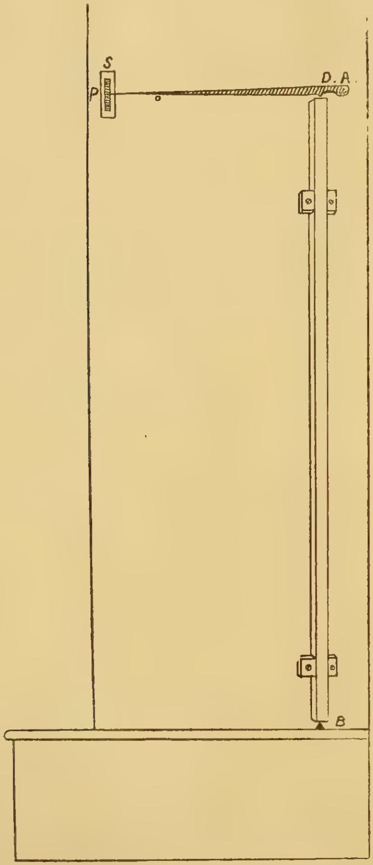
AN EXPERIMENT TO SHOW THE EXPANSION OF WOOD.

BY MR. HUGH D. VAIL.

A number of years ago I concluded to try the experiment of compensating an old fashioned clock by using a wooden rod for the pendulum with a lead pipe for the bob.

To do this it became necessary to know the relative expansion of the two materials by heat. That of lead was readily found in scientific tables; but none of these gave that of wood, and it even seemed a question whether wood expanded or contracted by heat. I therefore decided to test it myself. I procured some strips of straight grained, well seasoned white pine, and also of Spanish cedar, the kind ordinarily used in Philadelphia for the Surveyors' measuring rods. These were cut exactly of the same dimensions—an inch wide, three-fourth of an inch thick, and four feet long. As the expansion, if any, was likely to be extremely small, it was necessary to obviate all tendency to bend or twist. To do this I slit the rods flatwise with a fine saw, into exactly two equal parts, and then, after planing them smooth, I turned the outside of one part against the inside of the other and screwed them firmly together again. In this position the natural tendencies of the two halves to warp or twist, being equal and in opposite directions, neutralized each other.

The apparatus for testing their expansion was a very simple contrivance that I fitted up against the side of a book case standing near a window. A small steel point (B) fastened in this, about a foot from the floor, with the point upwards, formed the support for the rod when standing upright against the side of the book case. To hold the rod in place small pieces of wood were fastened to the case on both sides of it, near the top and bottom. An index (A P) to show the expansion, I made from very thin steel rolled for steel pens, by cutting with scissors, a narrow strip fifteen inches long, half an inch wide at one end and running to a sharp point at the other. This point having been made as fine and sharp as possible, and a small hole drilled near the other end, the index was fastened in place by driving a needle (A) through this hole into the book case, about an inch to the right and a little above the rod, so that when the index rested on the top of the rod it would be nearly horizontal. Before the index was put in place it was so cut as to leave a sharp point (D) on the the lower side to rest on the top of the rod, or rather on the flat surface of the head of a tack driven in the end of the rod. A similar hard surface was made for the point of contact below.



A small scale (S) made by drawing lines one hundredth of an inch apart on an ivory tablet, was fastened behind the index, so that the point rested against it. A pocket microscope held by a wire in front of the point served for reading its movements over the scale.

As the accuracy of the observations were dependent upon that of the scale, it should be stated that the lines had been drawn with great care on a large graduating instrument by Wm. J. Young, the mathematical instrument maker.

To test the expansion the wooden rod was first placed outside the window with a thermometer by the side of it, and left there until it was supposed to be of the same temperature as the air; it was then taken in and set in place under the index. Immediately, on looking through the microscope, the point of the index was seen moving slowly up the scale, showing not only that wood did expand, but that it did so almost instantly on being brought into the warm room. The heat of the room was shown by two thermometers, hung, one at the top, and the other at the bottom of the rod. In a few minutes, when the point of the index became stationary, its position on the scale was carefully noted, as its former position had been before, as well as the readings of the thermometers out-doors and in. The difference between that without and the mean of the two within was assumed as the increase in temperature; and from the difference of the two readings on the scale the corresponding increase in the length of the rod was easily computed.

The distance of the point of the index from the needle or centre of motion being 14.6 times as great as the point resting on the rod from the same centre, it must move 14.6 times as fast and as far. Then dividing the space passed over by the index on the scale should give the actual lengthening of the rod.

In one observation, for example, the outside thermometer marked 32°, and the two inside 61° and 57°, giving a mean 59°, and a difference of 27°. The readings on the scale were .540 and .569, showing a rise of .029 of an inch for the 27° increase of temperature. As the change of temperature was different at different times, the result of each observation was increased or diminished to correspond to a change of 30°. In this case it was done by adding 1-9 to the result for 27°, which gave .0322 of an inch, and this fraction divided by 14.6 gave .0022, or a little more than 1-500 of an inch as the entire expansion of a four foot rod for 30°

increase in temperature. This again divided by 48, the number of inches in the rod, gave .0000460, or less than 1-20000 part of the length as the increase in terms of the length.

Many like observations were made at various times, both with these rods and with others, as well as with glass tubes and lead pipes, and generally with a very fair agreement in the results.

It was very gratifying to be able thus to ascertain to a certainty that wood, like the metals did expand by heat. But to me the most interesting part of the experiment was to see the wonderfully minute space, we were able to measure by such simple means.

By taking the mean of the different observations, I obtained for the expansion of Spanish cedar in terms of its length, for 30° increase in temperature .0000688, and for that of white pine .0000464.

The actual extension of each rod, expressed approximately in vulgar fractions, was 1-300 and 1-450 of an inch, and these were about the largest spaces measured. What the smallest were it is difficult to say; but the greatest variation of the pine from the mean was about 1-4000 of an inch. If this is the extreme, it is quite safe to say that the probable error in the final result, so far as the measurement is concerned, could hardly be one-fourth as much, or less than 1-16000 of an inch—a space that it would require a good microscope to see.

SOLFATARAS IN THE VICINITY OF SANTA BARBARA.

BY PROF. HENRY CHAPMAN FORD.

DURING the summer of 1886, two localities in the neighborhood of Santa Barbara were visited where heated gases were issuing from the earth in sufficient quantities to merit attention. The first group of so-called "Fire Wells" or "Solfataras" is situated on the San Marcos ranch in the Santa Ynez valley, near the margin of a bluff, about 175 feet above the Santa Ynez river.

The space where the action is visible covers an area of from 75 to 100 feet in diameter, the whole being entirely bare of vegetation. There is at this point an outcrop of light colored shales, the stratification of which is nearly vertical, and in many places disintegrated on the surface. On approaching the locality a strong and intensely disagreeable odor, characterized evidently by bitumen and sulphur, permeated the atmosphere. By striking a pick into the broken shales or any portion of the bare area after penetrating a few inches, the temperature was found to be very warm to the touch. Distributed over the surface were eight or ten apertures from which rose visible sulphurous fumes to the height of from two to three feet. Without a thermometer the temperature of the gases upon their issue from their aperture, was undetermined, yet it was found to be so high that the hand could not for a moment bear the heat. The shales were much discolored at the issue and were covered with beautiful sublimed crystals of sulphur. During the cooler days of winter the fumes rose to a much greater height and were visible at a considerable distance. The warm ground at that season attracts the cattle, numbers seeking the neighborhood for their nightly bed. At the time of my visit the surface was strewn with quantities of grasshoppers that had evidently perished either from the heat or deleterious gases.

The second group of "Fire Wells" visited are about three-fourths of a mile below a point where the Rincon Creek enters the sea and near the carriage road and railway leading from Santa Barbara to Ventura. Before the grading of the railway was accomplished, the traveler by the beach road might have noticed some peculiar looking rocks that had fallen from the cliffs above. The rocks appear to have been originally similar to those composing the mass of the exposed portion of the cliff, which are principally light colored shales, but their character, both in density, specific gravity and color, has been altered by the action of mineral gases and great heat. Nearly all shades of red, yellow and brown, and in some cases green, are colors represented. The intensity of the heat at some former period seems to have contracted the strata through semi-fusion until it is excessively hard and gives a metallic ring when struck with a hammer.

Reaching by an easy path a point about 300 feet above the base of the cliff, I was at once aware of the near existence of the "Solfatara" or so-called "Rincon Volcano" by the same exceedingly disagreeable odors that were noted in the Santa Ynez issue.

Descending twenty or thirty feet I found hot gases bursting from numerous apertures in the shales, accompanied in some cases by melted bitumen that hardened in concretionary masses upon cooling. The dip of the strata was at an angle of 50° towards the mountain. Crystals of sulphur had also formed upon all objects near the issue and naptha appeared to be present. A few years ago a tunnel was run into the cliff at its base to the depth of 200 feet in search of oil. At this depth the workmen were obliged to cease operations in their endeavor to penetrate further on account of the great heat. Upon entering this tunnel I found the temperature still high but noticed only weak sulphurous gases. Near the entrance for fifty or sixty feet the roof and sides were thickly covered with attenuated colorless crystals of epsomite hanging in tufts and masses.

During the cooler months, as at the Santa Ynez locality, the gases arising from the principal orifices are seen from distant points and the issue of so much smoke and accompanying heat has given rise to a popular idea that it is due to volcanic action. The local journals have from time to time given voice to this idea, and the frequency of earthquake shocks in the neighborhood has been attributed to the struggling efforts of the "Rincon Volcano." When the excavations of the Southern Pacific Railway were made at a point a mile farther west from the locality just described, a similar issue was discovered,and upon touching a match to the gas, combustion ensued and continued, notwithstanding vigorous efforts were made to extinguish it. The fumes caused much annoyance to the laborers, and not until masses of earth were dumped over the orifice did it cease to burn.

The conditions at all the described localities appear to be identical. The geological formation is the same, and the same odors and depositions characterize each. It may be hardly proper to apply the name Solfatara to these gaseous issues, yet they have many characteristics of those outlets of internal action situated near active volcanoes. If not rightly coming under that head, they may belong to the class of gas-springs known as fire-wells,so called from the emanations of carburetted hydrogen, occasionally taking fire at the issue. These phenomenon can undoubtedly be traced to deep-seated chemical changes. Dr. Dauberry attributed them in Sicily to the slow combustion of beds of sulphur. Another authority states that the frequent occurrence of naptha and inflamable gas points to the disengagement of hydro-carbons from subterranean strata.

The recent discovery of natural gas by boring at Summerland, a few miles west of the Rincon issues, where it has no doubt been escaping from the surface for a long period, together with the "fire-wells" described, indicates that these hydro-carbons are abundantly generated in the strata underlying a considerable portion of Santa Barbara County, and that this valuable product may soon be obtained in sufficient quantities to be utilized for a host of purposes where a cheap fuel or lighting is required.

During the summer of 1888, Mr. Richardson, who resides a short distance below the Rincon "fire-wells" was startled by loud reports in their direction and upon visiting the locality observed flames issuing to the height of several feet from the apertures. Parties from Santa Barbara visited the spot upon hearing of this outburst and confirmed Mr. Richardson's observations.

Apparently there have been periods of great activity, followed by long intervals of comparative rest. The partially fused rocks, with their altered color and density would indicate a period of greater intensity of heat than at present prevails.

THE LYONOTHAMNUS ASPLENIFOLIUS.

BY PROF. HENRY CHAPMAN FORD.

In September, 1884, Mr. William S. Lyon of Los Angeles, in a botanical excursion to the Island of Santa Catalina, discovered a new shrubby plant that was referred to Dr. Asa Gray for nomenclature.

He created a new genus for the shrub under the name of Lyonothamnus, in honor of its discoverer, and for its profuse flowering gave it the specific distinction *floribundus*.

In the summer of 1885, Mr. Barclay Hazard of Santa Barbara, during a visit to the Island of Santa Cruz, noted a new and peculiar shrub, or small tree, and called the attention of the fact to Prof. E. L. Greene of the California University. During July of the following season (1886) Prof. Green visited the island and found Mr. Hazard's discovery to be a new species of *Lyonothamnus,* and later, in the Bulletin of the California Academy of Sciences, described it under the name of *Lyonothamnus Asplenifolius.*

In 1888 Mr. Brandegee found the same species on the island of Santa Rosa, but he states that "the trees were small and often distorted by the wind."

Prof. Green found it growing in a hundred fine groves distributed up and down the thirty miles of the northern slopes of Santa Cruz. He speaks of specimens often as high as thirty-five or forty feet, and says: "No other small tree of our coast equals this in grace of form, and beauty of foliage. The flowers too, are quite showy in their season, the larger corymbs often measuring a foot in diameter," adding that "the wood, close grained and hard, was called iron-wood by the men of the island."

As early in 1875, the writer was informed of the existence of this "iron-wood" and vainly endeavored to procure specimens at the hands of sailors and others frequenting the island.

It was not until this season, 1889, that opportunity offered a personal inspection of the growing trees. In a recent visit to Lady Harbor, Dr. Yates and myself climed the precipitous slopes near, and upon the rocky ridges we found large groups of Lyonothamus, obtaining specimens of the wood, bark, leaves and corymbs of seed capsules, which were shown at a late meeting of the society. The trees were in clumps of from five to fifteen individuals, and of different diameters, ranging from a half-inch to six or eight inches. The outer bark is deciduous, parting in tough strings from the trunks of the larger specimens, leaving the inner portion rich in reddish brown color. The beautiful fern like foliage seems to be deciduous, yet the tree may not be entirely bereft of leaves at any time. The flowering season had past, deprived us of judging of their beauty. The trunks are quite straight, the branches springing from them somewhat in whorls at regular intervals. We noticed no seedling specimens, yet it is probable that other localities might furnish them.

Examples of the wood of various diameters were obtained. It is exceeding close-grained, hard and of similar specific gravity of many tropical species. Specimens are in the process of seasoning with a probability that the wood will prove susceptible of taking a high polish with fine color. Notwithstanding its great weight proportionate to the size, it is said to be quite brittle when green. When seasoned it has long been a favorite wood for hand-spikes used by the sailors and others, who have knowledge of its strength.

The *Lyonothamnus Asplenifolius* adds another singularly beautiful tree to our already long and desirable list that should be introduced in ornamental planting. Its showy flowers, rare foliage and general novelty, should make it a favorite wherever planted. Its propagation by seeds ought not to be difficult, as they are produced in profusion.

It belongs to the order Saxifragaceæ, and is the first tree of the family that has yet been discovered in North America; most representatives of the order being herbs or shrubs. The Saxifrage family embraces about 75 genera, and 540 species, mostly found in the cool regions of the Northern Hemisphere.

The Astilbe, Escallonia, Hydrangea, Saxifraga and Ribes are the best known examples.

Santa Barbara, Sept. 28th, 1889.

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